

HoustonRefining

Spill Response & Prevention Plan (SRPP)

**Spill Prevention, Control, and
Countermeasure Compliance**

and

Facility Response Plan (FRP)

Prepared by:

**HSSE Environmental Department
12000 Lawndale, P.O. Box 2451
Houston, Texas 77252-2451**

TABLE OF CONTENTS

EMERGENCY RESPONSE ACTION PLAN

	Page
<u>1.0 INTRODUCTION</u>	1
<u>1.1 Summary</u>	1
<u>1.2 Companion Document</u>	2
<u>1.3 Certification and Information Summary</u>	2
<u>1.4 SRPP Amendments</u>	12
<u>1.5 Record of Change</u>	14
<u>2.0 FACILITY DESCRIPTION</u>	15
<u>2.1 Location and Processes</u>	15
<u>2.1.1 Facility Location</u>	15
<u>2.1.2 Production Facilities</u>	15
<u>2.1.3 Refinery Products</u>	16
<u>2.2 Bulk Storage</u>	16
<u>2.2.1 Storage Capacity</u>	16
<u>2.2.2 Tank Farms</u>	16
<u>2.2.3 Secondary Containment</u>	17
<u>2.2.4 Aboveground Fuel Storage Tanks</u>	19
<u>2.3 Pipelines</u>	20
<u>2.4 Vessel Data and Dock Information</u>	20
<u>2.5 Site Drainage Information</u>	22
<u>2.6 Identification of Facilities</u>	22
<u>2.6.1 Loading and Unloading Operations</u>	23
<u>2.6.2 Transfer Operations</u>	23
<u>2.7 Site Security</u>	24
<u>2.8 Communication</u>	24
<u>2.9 Inspection and Records</u>	24
<u>2.10 Environmental Permits</u>	24

	Page
<u>3.0 SPILL RESPONSE PROCEDURES</u>	26
<u>3.1 Standard Operating Procedures for Onshore Spills</u>	26
<u>3.2 Emergency Action Plan</u>	30
<u>3.3 Special Case: Marine Spills</u>	30
<u>3.3.1 Spill Response Team</u>	30
<u>3.3.2 Outside Contractors</u>	31
<u>3.3.3 Other Governmental Agencies</u>	31
<u>3.3.4 Logistics</u>	32
<u>3.4 Notification Requirements</u>	32
<u>3.5 Response Personnel</u>	36
<u>3.5.1 Qualified Individual</u>	36
<u>3.5.2 Emergency Response Personnel</u>	37
<u>3.5.3 Contractor Response Personnel</u>	37
<u>3.6 Response Equipment</u>	37
<u>3.6.1 On-site Equipment</u>	37
<u>3.6.2 Contractor Equipment</u>	37
<u>3.7 Determining Spill Flow Direction in Houston Ship Channel</u>	39
<u>3.8 Facility Security System</u>	39
<u>3.8.1 Security System Description</u>	40
<u>3.8.2 Access Control</u>	40
<u>3.8.3 Evacuation and Personnel Evacuation</u>	41
<u>3.8.4 Other Security Considerations</u>	42
<u>3.8.5 Planned Security Upgrades</u>	42
<u>4.0 ANALYSIS OF POTENTIAL SPILLS</u>	43
<u>4.1 Worst Case Discharge</u>	43
<u>4.2 Medium Discharge</u>	45
<u>4.3 Small Discharge</u>	45
<u>4.4 Historical Oil Discharges</u>	46
<u>4.5 Discharge Characteristics from Equipment Failure</u>	46
<u>4.5.1 Storage Tank Leak or Failure</u>	46
<u>4.5.2 Tank Overfill</u>	46
<u>4.5.3 Tankcar/Tank Truck Overfill, Hose Failure in Loading Rack Area</u>	47
<u>4.5.4 Pipeline Manifold Areas, Equipment Failure</u>	47

	Page
<u>5.0 SPILL MITIGATION PROCEDURES</u>	48
<u>5.1 Mitigation Procedures for Operational Activities</u>	48
<u>5.1.1 Procedures for Equipment Leaks and Spills</u>	48
<u>5.1.2 Procedures for Fires and Explosions</u>	50
<u>5.1.3 Spill Mitigation and Shutdown Sequence</u>	50
<u>5.2 Oil Discharge Mitigation Procedure</u>	51
<u>5.2.1 Worst Case Discharge – Land & Water</u>	51
<u>5.2.2 Worst Case Discharge – Pipeline</u>	52
<u>5.2.3 Maximum Most Probable Discharge</u>	53
<u>5.2.4 Average Most Probable Discharge</u>	55
<u>5.3 Spill Recovery Strategies</u>	57
<u>5.3.1 Mechanical Recovery</u>	57
<u>5.3.2 Recovered Oil Storage</u>	58
<u>5.3.3 Separation of Oil, Water, and Debris</u>	59
<u>5.3.4 Waste Minimization</u>	59
<u>5.4 Waste Disposal</u>	59
<u>5.4.1 Waste Material Identification</u>	59
<u>5.4.2 Disposal Procedure</u>	60
<u>5.4.3 Transportation of Waste</u>	60
<u>5.5 Environmentally Sensitive Area</u>	61
<u>5.6 Wildlife Protection and Rehabilitation</u>	62
<u>5.7 Vulnerability Analysis</u>	63
<u>6.0 HAZARDOUS MATERIAL IDENTIFICATION</u>	66
<u>7.0 EQUIPMENT INSPECTION AND TESTING</u>	67
<u>7.1 Process Equipment and Piping</u>	67
<u>7.2 Marine Spill Response Equipment</u>	69
<u>7.3 Onshore Spill Response Equipment</u>	69

	Page
<u>8.0 PERSONNEL TRAINING AND DRILLS</u>	72
<u>8.1 Training Procedures</u>	72
<u>8.1.1 SRPP Training</u>	72
<u>8.1.2 HAZWOPER Training</u>	72
<u>8.1.3 Levels of Qualification</u>	75
<u>8.1.4 Marine Spill Team Training</u>	76
<u>8.1.5 Qualified Individual Training</u>	77
<u>8.2 Drills</u>	78
<u>8.2.1 Qualified Individual Notification Drill</u>	78
<u>8.2.2 Emergency Response Team Drills</u>	78
<u>8.2.3 Pipeline Spill Drills</u>	78
<u>8.2.4 Marine Spill Team Drills</u>	78
<u>8.2.5 Area Exercises</u>	79
<u>8.2.6 Triennial Exercise of the Entire Response Plan</u>	79
<u>8.2.7 Summary</u>	80

LIST OF TABLES

	Page
Table 1-1	Regulatory Cross Reference Table2
Table 1-2	Definitions2
Table 1-3	Record of Change14
Table 2-1	Tank Capacities16
Table 2-2	Top Ten Oils Stored by Volume17
Table 2-3	Bulk Storage Tank Farm Areas17
Table 2-4	Oil-Filled Electrical Equipment List18
Table 2-5	Basins Summary18
Table 2-6	Secondary Containment Areas for Bulk Storage Tanks18
Table 2-7	HRO Pipelines in Tunnel Under Roadways20
Table 2-8	Environmental Permits and Authorizations25
Table 3-1	Internal Notification References27
Table 3-2	External Notification References33
Table 3-3	Notification Data Sheet35
Table 3-4	HRO Emergency Spill Response Equipment38
Table 4-1	EPA Calculated Volume for Persistent and Non-Persistent Oils43
Table 4-2	USCG Worst-Case Discharge Volume Calculation – Marine Docks44
Table 4-3	Historical Tank Failures (1996 – 2013)46
Table 5-1	Response Options for Substances with Properties Similar to Oil58
Table 5-2	Oil Spill Protection Response Options58
Table 5-3	Waste Transporters and Disposal Locations60
Table 5-4	Location of Environmentally Sensitive Areas61
Table 5-5	Federally Endangered Species – Harris County, TX62
Table 6-1	List of Hazardous Chemicals and Reportable Quantities66
Table 6-2	Hazardous Waste Classification66

LIST OF FIGURES

	Page
Figure 1-1	Implementation Requirements for the Plan.....3
Figure 1-2	Professional Engineering Certification.....4
Figure 1-3	Certification of the Applicability of Substantial Harm Criteria5
Figure 1-4	Certification of Response Preparedness6
Figure 1-5	Management Commitment6
Figure 1-6	Management Approval7
Figure 1-7	Facility Information8
Figure 1-8	DOT PHMSA Operator’s Statement of Significant and Substantial Harm11
Figure 2-1	Refinery Map and Area Topography Map.....15
Figure 2-2	Refinery Plot Plan15
Figure 2-3a	Cathodic Protection Rectifier Location Plan.....18
Figure 2-3b	Contractor Oil Storage Location Diagram.....18
Figure 2-4	Location of Pipeline Section s and Block Valves for Lines D thru K.....20
Figure 2-5	Dock Plot Plan21
Figure 2-6	Dock A Product Line Layout.....21
Figure 2-7	Dock B Product Line Layout.....21
Figure 2-8	Dock C Product Line Layout.....21
Figure 2-9	USCG Approval for Alternate Compliance with Pressure Testing21
Figure 3-1	Emergency Operations Structure28
Figure 3-2	Emergency Response – Command Structure29
Figure 3-3	Clean Channel Association OSRO Certifications.....31
Figure 3-4	Garner Environmental Services OSRO Certifications.....31
Figure 3-5	Clean Channel Association Resource Manual.....37
Figure 3-6	Garner Environmental Services Response Rate Schedule.....37
Figure 3-7	Clean Channel Association Spill Response Equipment.....37
Figure 3-8	Garner Environmental Services Spill Response Equipment37
Figure 3-9	Texas GLO Staged Equipment.....37
Figure 3-10	Houston Refinery Evacuation Map41
Figure 4-1	Worst-Case Spill Calculations45
Figure 5-1	Environmentally Sensitive Impact Areas.....52
Figure 5-2	Response Resource Operating Criteria of Oil Recovery Devices58
Figure 7-1	Tank Inspection Form.....68
Figure 7-2	Marine Response Inspection Form.....70
Figure 8-1	ERT Drill Checklist81
Figure 8-2	ERT Training Documentation Form.....83
Figure 8-3	Inspector Qualification Matrix84

ACRONYMS & ABBREVIATIONS

ACP	Area Contingency Plan
bbls	Barrels
C&P	Compound & Packaging
CCA	Clean Channel Association
CFR	Code of Federal Register
COTP	Captain of the Port
DOT	Department of Transportation
EAP	Emergency Action Plan
EGB	East Guard Basin
EIB	East Impoundment Basin
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ERT	Emergency Response Team
GCA	Gulf Coast Authority
GLO	General Land Office
HAZMAT	Hazardous Material
HAZWOPER	Hazardous Waste Operations and Emergency Response
HRO	Houston Refining LP
IC	Incident Commander
ICS	Incident Command System
LEPC	Local Emergency Planning Committee
MSDS	Material Safety Data Sheet
MTSA	Maritime Transportation Security Act
NCP	National Contingency Plan
OSRO	Oil Spill Response Organization
PHMSA	Pipeline and Hazardous Materials Safety Administration
QI	Qualified Individual
SOC	Security Operations Center
SPCC	Spill Prevention Control and Countermeasures
SRPP	Spill Response and Prevention Plan
TAC	Texas Administrative Code
TCLR	Tank Car Loading Rack
TPDES	Texas Pollution Discharge and Elimination System
TWIC	Transportation Workers Identification Credential
UL	Underwriter Laboratories
USCG	United States Coast Guard
WGB	West Guard Basin
WIB	West Impoundment Basin

1.0 INTRODUCTION

1.1 SUMMARY

Houston Refining LP (HRO) is required to document compliance with certain Federal and Texas agency mandated regulations. In addition, these regulatory agencies have determined that the facility, because of its location, could reasonably be expected to cause substantial harm to the environment by accidentally discharging oil into or on the navigable waters or adjacent shoreline. The plan contained here has been prepared to meet the following regulatory requirements as listed below:

REGULATORY AGENCY	AREA OF CONCERN	REGULATORY CITATION
United States Environmental Protection Agency (EPA)	Land	§40 CFR 112
United States Coast Guard (USCG)	Water	§33 CFR 153, 154, and 156
United States Department of Transportation (DOT) - Pipeline and Hazardous Materials Safety Administration (PHMSA)	Pipeline	§49 CFR 194
Texas General Land Office (GLO)	Coastal Waterways	§31 TAC 19

HRO ensures compliance with federal Spill Prevention Control and Countermeasure (SPCC) rules, discharge prevention regulations, and guidelines since they are more stringent than state requirements.

The HRO *SPCC Plan and Oil Spill Response Plan* have been combined to create the *Spill Response and Prevention Plan (SRPP)*. Specifically, this Plan:

- ✓ Identifies the Qualified Individual (QI) having full authority to implement removal actions;
- ✓ Specifies required immediate communication between those individuals and the appropriate Federal officials and the persons providing spill response personnel and equipment;
- ✓ Describes the storage capacity of the facility;
- ✓ Identifies, and provides by contract, or other means approved by the Vice President Manufacturing, the availability of private personnel and equipment necessary to:

- Remove to the maximum extent practicable a worst-case discharge (including a discharge resulting from fire or explosion);
 - Mitigate to prevent a substantial threat of such a discharge;
 - Mitigate or prevent damage to fish, wildlife and environmental sensitive areas.
- ✓ Describes the training, equipment testing, periodic drills, and response actions of persons at the facility.
 - ✓ Is consistent with the National Contingency Plan (NCP), the EPA Region VI Inland Area Contingency Plan (ACP), and the Galveston Bay ACP.

A cross-reference table for all the applicable regulations is provided in [Table 1-1](#), and definitions used in this document are provided in [Table 1-2](#).

1.2 COMPANION DOCUMENT

A companion HRO document, the [Emergency Action Plan \(EAP\)](#) is used in conjunction with this *Spill Responses and Prevention Plan (SRPP)*. The EAP contains all the facility procedures for handling various types of emergency situations, including fires, spills, medical, training, and communication. Since all that information is contained in the EAP, none of those details are repeated in this document to avoid any possibility of confusion and inconsistency in applying emergency procedures. Therefore, the EAP and the SRPP are complementary documents maintained electronically in LiveLink.

1.3 CERTIFICATION AND INFORMATION SUMMARY

The following figures meet the following certification requirements:

- ✓ [Figure 1-1](#) provides the Implementation Requirements for the Plan;
- ✓ [Figure 1-2](#) provides the Professional Engineer's Certification [§40 CFR 112.3(d)];
- ✓ [Figure 1-3](#) provides the Certification of the Applicability of Substantial Harm Criteria;
- ✓ [Figure 1-4](#) provides the Certification of Response Preparedness [§49 CFR 194.119(e)];
- ✓ [Figure 1-5](#) provides the Management Commitment Certification [§40 CFR 112.20];
- ✓ [Figure 1-6](#) provides the Management Approval of this Plan;
- ✓ [Figure 1-7](#) provides the Facility Information; and
- ✓ [Figure 1-8](#) provides the DOT PHMSA Operator's Statement of Significant and Substantial Harm

Figure 1-1 Implementation Requirements for the Plan

Implementation Requirements for Spill Response and Prevention Plan Houston Refining LP		
<p>Examination of the facilities covered by this SRPP has identified the need for corrective action to bring the Houston Refinery into compliance with the Spill Prevention, Control and Countermeasures Planning requirements detailed in §40 CFR 112.</p> <p>The Plan will be approved and certified by our staff Professional Engineer upon satisfactory completion and documentation of the corrective action items listed below. In accordance with §40 CFR 112.5 (a), the noted corrective actions must be completed within six (6) months.</p>		
Corrective Action Items	Scheduled Date	Completion Date*
1. For tanks located north and adjacent to former MEK Unit, permanently closed tanks per §112.2 OR construct a berm along the east side of the southeast corner of the heavy oils tank farm to ensure that drainage from the area flows into the in-plant drainage system per §112.8(b).	09/27/13	04/29/13
2. Contractor containers ≥55 gallons used to store oil are not identified in the SRPP. If contractor containers are listed in the SRPP, include documentation whether discharges flow into the in-plant drainage system or secondary containment is provided per §112.8(c).	04/30/13	04/16/13
3. Include list of oil-filled operational equipment as defined by §112.2 with capacities ≥55 gallons in SRPP and include documentation whether discharges flow into the in-plant drainage system or secondary containment is provided per §112.8(c).	04/30/13	04/10/13
MANAGEMENT APPROVAL OF THE COMPLETION OF IMPLEMENTION ITEMS		
Date: <u>5/1/2013</u>		
Management Signature: <u>Todd C. Monett</u>		
Name and Title: <u>Todd C. Monett, Site Manager Houston Refining</u>		

Figure 1-2 Professional Engineering Certification

PROFESSIONAL ENGINEER CERTIFICATION

By means of this Professional Engineer Certification, I hereby attest, to the best of my knowledge and belief, to the following:

- ✓ I am familiar with the requirements of 40 CFR Part 112 and have verified that this Plan has been prepared in accordance with the requirements of this Part.
- ✓ I or my agent visited and examined the Facility on February 5, 2013. My certification is based upon the condition of the Facility as of this date. Any material changes to the Facility made subsequent to this date must be separately reviewed, documented and P.E. certified as a Technical Amendment, as appropriate.
- ✓ I have verified that this Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards.
- ✓ I have verified that the required inspection and testing procedures have been established as described in this Plan.
- ✓ I have verified that the Plan is adequate for the Facility.
- ✓ My certification of this Plan in no way relieves the owner/operator of the Facility of their duty to prepare and fully implement the Plan in accordance with the requirements of 40 CFR Part 112. The attestations listed above are limited to only those facilities, programs, practices, and procedures pertaining to oil and oil products. I in no way assume any liability of whatsoever kind or nature by my certification.
- ✓ The owner/operator, by "Management Approval" located on the following page, acknowledges this certification and the compliance measures described herein.
- ✓ This certification is limited to the sections referenced in the Spill Prevention, Control, and Countermeasure Plan (40 CFR 112) cross reference.
- ✓ This Plan is valid only to the extent that the Facility Owner or Operator maintains, tests, and inspects equipment, containment, and other devices as prescribed in this Plan and completes any Implementation Requirements.

(Seal)



Ralph Chaiet P.E.

Registered Professional Engineer

Ralph Chaiet, P.E.
Compliance Consultant
Witt O'Brien's
State of Texas Registration No: 75161

Firm Registration No. F-2180

Date of Seal/Signature: 3/29/2013

Figure 1-3 Certification of the Applicability of Substantial Harm Criteria

Facility Name: Houston Refining LP
 Facility Address: 12000 Lawndale, Houston, TX 77017

1. Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons? YES NO
2. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation within any aboveground oil storage tank area? YES NO
3. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C-III to this appendix or a comparable formula ¹) such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments? *For further description of fish and wildlife and sensitive environments, see Appendices I, II, and III to DOC/NOAA's "Guidance for Facility and Vessel Response Plans: Fish and Wildlife and Sensitive Environments" (see Appendix E to this part, section 13, for availability) and the applicable Area Contingency Plan.* YES NO
4. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C-III to this appendix or a comparable formula ¹) such that a discharge from the facility would shut down a public drinking water intake ²? YES NO
5. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and has the facility experienced a reportable oil discharge in an amount greater than or equal to 10,000 gallons within the last 5 years? YES NO

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

Todd C. Monette
 Signature

Todd C. Monette
 Name (please type or print)

Site Manager Houston Refining
 Title

4-17-13
 Date

¹ If a comparable formula is used, documentation of the reliability and analytical soundness of the comparable formula must be attached to this form.

² For the purposes of 40 CFR part 112, public drinking water intakes are analogous to public water systems as described at 40 CFR 143.2(c).

Figure 1-4 Certification of Response Preparedness

Houston Refining LP hereby certifies that it has obtained through contract or other means, the necessary private personnel and equipment to respond, to the maximum extent practicable, to a worse-case discharge or a substantial threat of such a discharge.

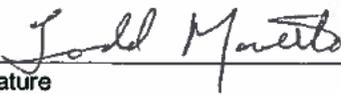
 _____ Signature	Site Manager Houston Refining _____ Title
Todd C. Monette _____ Name (please type or print)	4-17-13 _____ Date

Figure 1-5 Management Commitment

Based on my inquiry of those individuals responsible for obtaining information, I certify under penalty of law that the Facility Response Plan (FRP) and the Spill Response and Prevention Plan (SRPP) has been reviewed and updated as needed, and I believe that the submitted information is true, accurate, and complete.

 _____ Signature	Site Manager Houston Refining _____ Title
Todd C. Monette _____ Name (please type or print)	4-17-13 _____ Date

Figure 1-6 Management Approval

Owner/Operator responsible for Facility: <u>Houston Refining LP</u>	
<ul style="list-style-type: none"> • Facility Name and (Physical) Location: <u>Houston Refining LP</u> <u>12000 Lawndale</u> <u>Houston, TX 77017</u> 	
<ul style="list-style-type: none"> • By signature below, the Manager approves this Plan and acknowledges that the SPCC elements identified (see Table 1-1, 40 CFR §112) within this Plan have been implemented. • This page may be used for the initial Management Approval or for subsequent change of management and/or change of designated person accountable. 	
<ul style="list-style-type: none"> • This SRPP will be implemented as herein described. 	
Signature: <u><i>Todd Monette</i></u>	Designated person accountable for oil spill prevention at the Facility:
Name: <u>Todd C. Monette</u>	Name: <u>Todd C. Monette</u>
Date: <u>4-17-13</u>	Title: <u>Site Manager Houston Refining</u>
Title: <u>Site Manager Houston Refining</u>	
<ul style="list-style-type: none"> • This SRPP will be implemented as herein described. 	
Signature: _____	Designated person accountable for oil spill prevention at the Facility:
Name: _____	Name: _____
Date: _____	Title: _____
Title: _____	
<ul style="list-style-type: none"> • This SRPP will be implemented as herein described. 	
Signature: _____	Designated person accountable for oil spill prevention at the Facility:
Name: _____	Name: _____
Date: _____	Title: _____
Title: _____	

Figure 1-7 Facility InformationLast Update Date: February 22, 2013Main Office Name: Houston Refining LPStreet Address: 12000 Lawndale St.City: Houston State: Texas Zip: 77017-2740

Mailing Address (if different from above):

Street Address: PO Box 2451City: Houston State: Texas Zip: 77252-2451County: Harris Phone Number: (713) 321-4111Facsimile Number: 713.321.6820 (HSSE) or 713.321.6835 (PSS)Latitude: (b) (7)(F), (b) (3)

Longitude

(b) (7)(F), (b) (3)NCP Response Zone: _____ Inland: X CoastalOwner: Houston Refining LPOwner Address: same (If different from facility address)Owner Facility's Contract: Todd Monette Phone Number: 713.321.4111Street Address: 12000 LawndaleCity: Houston State: Texas Zip: 77017-2740**Qualified Individual:**Name: Plant Shift SuperintendentPosition: This person at the refinery 24/7 and is a shift position covered by 5 peopleAddress: 12000 Lawndale, Houston, TX 77017-2740Emergency Phone Number: 713.321.4223 (PSS) or 713.321.4211 (Security Operations Ctr)Training: Annual Emergency Action Plan Review Regulatory TrainingAnnual Emergency Response Preplan MeetingAnnual (or as needed) On-Scene Incident Command TrainingUnannounced Drills

Figure 1-7 Facility Information (continued)

Date of Storage Start-up: The refinery began operation under Sinclair in January 1920 and has been operated by several other companies over the years including Atlantic Richfield, Lyondell Petrochemical, Lyondell-Citgo Refining, and Lyondellbasell. When Sinclair and its subsidiaries merged with Atlantic Richfield Company (ARCO) in 1969, the refinery became part of ARCO Petroleum Products Company. In 1985, the refinery and a portion of ARCO Chemical Company's Channelview complex were combined to create the Lyondell Petrochemical division of ARCO. Two years later, Lyondell Petrochemical became a public company breaking away from ARCO. In 1993, Lyondell Petrochemical Company and CITGO Petroleum Corporation created a jointly-owned company to operate the Houston Refinery until August 2006 when Lyondell fully acquired Houston Refining from CITGO. Lyondell Petrochemical maintained sole ownership until December 2007 when the refinery became a wholly owned subsidiary of LyondellBasell Industries.

Current Operation: Houston Refining LP is a fully integrated petroleum refinery which produces gasoline, diesel, kerosene, jet fuel, gas oils, lubricants, coke, sulfur, and fuel gases. Most distillate products are ultimately sent to the East Coast and Midwest via the Colonial and Explorer pipelines.

Number of Oil Storage Vessels:	<u>259</u> (Aboveground Storage Tanks)
	<u>215</u> (Drum/Tote Storage), Approx.
	<u>0</u> (Underground Storage Tanks)
	<u>2,637</u> (Manufacturing and Operational)
	<u>6</u> (Surface Impoundments)

Largest Aboveground Oil Storage Tank:	(b) (7)(F), (b) (3)	(Gallons)
Maximum Oil Storage Capacity (Gallons):	(b) (7)(F), (b) (3)	(Aboveground Storage Tanks)
		(Contractor Drum/Tote Storage)
		(Underground Storage Tanks)
		(Manufacturing & Operational)
		(Surface Impoundments)
Worst Case Oil Discharge Amount	(b) (7)(F), (b) (3)	(Gallons)

Wellhead protection area: The facility is not located in a wellhead protection area.

Facility Distance to Navigable Water: 0 – 1/4 mile

Figure 1-7 Facility Information (continued)

EPA FRP ID Number: FRP-06-TX-00040
 Primary SIC Code: 2911 (Petroleum Refining)
 Primary NAICS Code: 324110 (Petroleum Refining)
 Dun & Bradstreet Number: 80--63-2-22 (DUNS Number)

Dates and Types of Substantial Expansions: Under operation by Sinclair, the refinery's 732 Fluidized Catalytic Cracking Unit (FCCU) and the 630/631 Hydrodesulfurization (HDS) units were commissioned in 1953 and 1958, respectively. In the early 1960s, the Lubes Complex was constructed for processing Grade A naphthenic crude oil and select feedstocks to produce several grades of white oils and lubricating oils. When Sinclair merged with ARCO in 1969, the 736 Coker was commissioned. In 1976, a major expansion of the refining occurred which included commissioning of the 230 Gas Plant, 633 HDS, 634 HDS, 635 HDS, 433 Claus, 434 Claus, 435 Tail Gas Unit, and 536 Crude. Just after the formation of Lyondell-CITGO Refining, another major expansion of the refining occurred in 1996/97 which included commissioning of the 439 Claus, 440 Tail Gas Unit, 636 HDS, 537 Crude, and 737 Coker. Following this last major expansion, the 637 HDS was placed into service in 2006 to meet ultra-low sulfur standards, and the 433 and 434 Claus were completely rebuilt with O₂ enrichment in 2011 and 2012, respectively.

Facility-Specific Information: Tanks used in marine transfer operations including the tank size, roof configuration, and maximum fill capacity is presented in [Table 2-1](#), and the line length, pipe diameter, and the product or feedstock transferred through each marine loading arm is presented in [Table 4-2](#). [Figure 2-2](#) indicates the locations of all mooring areas and transfer locations at HRO, and the layout of the Marine Transfer Operation is illustrated in [Figure 2-5](#). The refinery has four berths, designated as "Dock A," "Dock B," "Dock C," and "Dock D." These facilities can accommodate vessels ranging in size from a "lightered"

(b) (7)(F), (b) (3)

The product line layout and the various block valves separating the marine transfer manifold from the refinery piping system for Docks A, B, and C is illustrated in [Figure 2-6](#), [Figure 2-7](#), and [Figure 2-8](#), respectively. A complete set of Material Safety Data Sheets ([MSDS](#)) for all product streams, intermediates, and purchased chemicals used at the refinery is maintained electronically and available online through the HRO Health, Safety, Security, and Environmental (HSSE) webpage.

**Figure 1-8 DOT PHMSA Operator's Statement of
Significant and Substantial Harm**

1. Is the pipeline >6½ inches (168 mm) in outside nominal diameter, greater than 10 miles (16.1 km) in length? and YES NO
2. Has any line section experienced a release greater than 1,000 barrels (159 cubic meters) within the previous five years? or YES NO
3. Has any line section experienced two or more reportable releases, as defined in 49 CFR 195.50, within the previous five years? or YES NO
4. Does any line section contain any electric resistance welded pipe, manufactured prior to 1970 and operates at a maximum operating pressure established under 49 CFR 195.406 that corresponds to a stress level greater than 50 percent of the specified minimum yield strength of the pipe? or YES NO
5. Is any line located within a 5-mile (8 km) radius of potentially affected public drinking water intakes and could reasonably be expected to reach public drinking water intakes? or YES NO
6. Is any line located within a 1-mile (1.6 km) radius of potentially affected environmentally sensitive areas and could reasonably be expected to reach these areas? YES NO

Based on the U.S. DOT PHMSA criteria above, the Facility is not considered "Significant and Substantial Harm".

Todd C. Monette
Signature

Todd C. Monette
Name (please type or print)

Site Manager Houston Refining
Title

4-17-13
Date

1.4 SRPP AMENDMENTS

The Plan will be reviewed annually within one (1) month of the anniversary date of the Captain of the Port (COTP) approval of the Plan (USCG requirement). It will also be revised as necessary and resubmitted for approval within 60-days (30-days for pipeline related revisions) including at such time, if ever, as:

- ✓ Applicable regulations are revised;
- ✓ The plan fails in an emergency;
- ✓ The facility changes (in design, construction, operation, maintenance, etc.) in a way that materially increases the potential for fires, explosions, releases of hazardous waste, or changes the response necessary in an emergency and within 30 days of significant change in operating conditions.
- ✓ An extension of the existing pipeline(s) or construction of a new pipeline in a response zone not covered by the previously approved Plan;
- ✓ Relocation or replacement of the pipeline(s) in a way that substantially affects the information included in the response plan, such as a change to the worst-case discharge volume;
- ✓ A change in the QI;
- ✓ A change in the NCP or an ACP that has significant impact on the equipment appropriate for response activities;
- ✓ A change in the listings of fish and wildlife and sensitive areas identified in the ACP.
- ✓ The on-site spill control equipment or emergency response procedures significantly change;
- ✓ A change in the type of oil handled, stored or transferred that materially alters the required response resources;
- ✓ A review of drill critique information indicates Plan changes are needed;
- ✓ The list of approved oil spill contractors changes, or a material change in their capabilities; and
- ✓ Any other changes that materially affect the implementation of the response plan.
- ✓ Plan review opportunities may occur during response team tabletop exercises or actual emergency responses.

Since the Plan is available online throughout the facility, all revisions are made electronically and do not require internal distribution. Plan revisions are submitted to the DOT-PHMSA and EPA in electronic format (via data CD) and in hard copy to the USCG.

All amendments which could materially affect the facility's potential for discharge into navigable waters of the United States or adjoining shorelines, except for changes to personnel and telephone references, must be certified by a Registered Professional Engineer to satisfy the requirements of §40 CFR 112 (Refer to [Figure 1-2](#) for certification of this plan).

- ✓ SPCC technical amendments are certified by a Registered Professional Engineer and documented in the located in the Figure 1-2. Amendments will be detailed with a stand-alone certified technical PE Certification page behind the initial "Professional Engineer Certification".
- ✓ This Plan will be revised when there are changes in the Facility's design, construction, operation, or maintenance *that materially affects the Facility's potential for the discharge of oil into or upon the navigable waters of the United States or adjoining shorelines*. Such amendments shall be fully implemented as soon as possible, but not later than six (6) months after such change occurs.

Changes requiring revision may include, but are not limited to:

- ✓ Commissioning or decommissioning of containers.
- ✓ Replacement, reconstruction, or movement of containers.
- ✓ Reconstruction, replacement, or installation of non-transportation-related piping systems.
- ✓ Construction or demolition that might alter secondary containment structures and/or drainage systems.
- ✓ Revision of standard operating or maintenance procedures at the Facility.
- ✓ Non-technical amendments are not certified by a Registered Professional Engineer.

Changes requiring revision may include, but are not limited to:

- ✓ Phone numbers.
- ✓ Personnel changes.
- ✓ Non-technical text changes.

In addition to updating the Plan with technical and non-technical amendments, the Plan must be reviewed by Management no less than once every five (5) years for more effective prevention and control technology. Two (2) electronic copies of the Plan will be submitted to the DOT PHMSA Office of Pipeline Safety every 5 years from the last submission date as required by §49 CFR 194.121(a)(1).

- ✓ At least once each five (5) years, the Facility will complete a review and evaluation of the SRPP. Based upon the results, make any amendments within six (6) months of the review and implement amendments, as soon as possible, but not later than six (6) months following preparation of any amendment.
- ✓ This will include, at a minimum, a review of more effective prevention and control technology, which may significantly reduce the likelihood of a discharge event from the Facility, if such technology has been field-proven at the time of the review.

1.5 RECORD OF CHANGE

Each change or update made to this Plan will be recorded on [Table 1-3](#). The persons reviewing and recording the change will initial the appropriate space.

2.0 FACILITY DESCRIPTION

2.1 LOCATION AND PROCESSES

2.1.1 Facility Location

Houston Refining LP (HRO) is located at 12000 Lawndale in Houston, Texas. The facility is sited on approximately 700 acres located in the City of Houston and the City of Pasadena on the south bank of the Houston Ship Channel. The refinery is located generally north of State Highway 225 between Scarborough and Allen-Genoa, approximately 3 miles east of IH610, and due east of Sims Bayou.

A location map of the refinery and surrounding area is provided in [Figure 2-1](#). In addition, the facility is located within the boundaries of the Houston Local Emergency Planning Committee (LEPC). The refinery is an active participant in the Pasadena, Galena Park, and Houston LEPCs.

2.1.2 Production Facilities

HRO is a large integrated petroleum refinery with a nominal crude oil (combined heavy sour crude and "Grade A" crude) processing capacity of around (b) (7)(F), (b) (3) per day and is comprised of numerous manufacturing process units. The processing units at HRO include: two heavy Crude Units, two Coker Units, a Sulfur Recovery Complex, a Fluidized Catalytic Cracking Unit, seven Hydro-desulfurization Units, two Reforming Units, a Lubes Complex, and various other production and treating units. The facility operates 24 hours per day, 7 days per week, and maintains a staff of approximately 850 people (excluding contractors). A facility site map depicting location of processes and equipment is provided in [Figure 2-2](#).

The facility is a full conversion refinery, which means that HRO has the capability to process virtually the entire barrel of varying types of crude oil into high-value products without producing lower-value residual fuel oil. The refinery has complete lubricating oil manufacturing facilities as well as finished blending facilities.

A major facility upgrade was completed in 1997 that significantly increased the amount of heavy crude that can be processed. Major components of the upgrade project include new coking, hydrotreating, sulfur recovery units, crude distillation unit, along with modifications to the facility's largest crude distillation unit. The refinery's processing capability now includes new hydrotreating units for meeting EPA ultra-low sulfur specifications for diesel and reformulated gasoline.

2.1.3 Refinery Products

Products from HRO include various types of gasoline, diesel fuel heating oil, jet fuel, sulfur, coke, and a comprehensive line of lubricants including automotive and industrial oils and greases, process oils, and refined white oils. The refinery also produces various aromatic streams including benzene and toluene as well as olefin feedstocks for polymer production. A complete set of Material Safety Data Sheets ([MSDS](#)) for all product streams, intermediates, and purchased chemicals used at the refinery is maintained electronically and available online through the HRO Health, Safety, Security, and Environmental (HSSE) webpage.

Production units no longer maintain hardcopy Hazard Communication Manuals at the unit since all PI&Ds, Process Flow Diagrams, and MSDSs for each refinery stream are maintained electronically and available online. A listing of the specific refinery streams (MSDS numbers) used in each production area can be found in LiveLink.

2.2 BULK STORAGE

2.2.1 Storage Capacity

(b) (7)(F), (b) (3)

. Most bulk storage in the refinery is dedicated single service tanks used for storing crude oil, finished fuels, lubricants, or various intermediates such as gas oils, naphtha, resid, chemicals, or other feedstocks. However, there are a few multi-service bulk storage tanks available to provide some operational flexibility.

A summary of tank capacities by tank number is provided in [Table 2-1](#). Included in this table is available information on materials stored, container roof design, and the year the tanks was built or re-built. Additionally, the top ten oils stored at the refinery by volume are listed in [Table 2-2](#).

2.2.2 Tank Farms

All bulk storage tanks are designed and constructed for maximum design pressure and operating temperature with materials compatible with the products being stored. Tanks used for oil storage are constructed of welded plate steel, and all applicable American Petroleum Institute (API) and American Society of Mechanical Engineers codes are followed during design and construction.

Most large bulk storage tanks at the refinery are located away from process operating area and aggregated together in tank farms whereas small storage tanks (day tanks) may be located near process operating areas. [Table 2-3](#) below lists the cost centers associated with various tank farms or areas where material are stored.

Table 2-2 Top Ten Oils Stored by Volume

Rank	Material	MSDS	Volume (bbls)
1	Crude Petroleum Oil	AP0001	(b) (7)(F), (b) (3)
2	Finished Gasoline	AP0817, AP1175	
3	Natural Gasoline/Condensate	AP0730, RS0153	
4	No. 2 Fuel Oil	AP0741	
5	Cracking Stock	AP0248, AP0883	
6	Heavy Straight Run Naphtha	RS0125	
7	Coker Feed	AP0381	
8	Jet A Fuel	AP0463	
9	Carbon Black Oil	AP0701	
10	OP-400 Naphtha	RS0152	

Table 2-3 Bulk Storage Tank Farm and Areas

Cost Center	Tank Farm / Area	Materials Stored
133	225 Tank Farm	Heavy Crude
134	West Tank Farm	Heavy Crude, Intermediates
135	South & Allendale Tank Farms	Gasoline, Diesel, Kerosene
136	East Tank Farm	Heavy Crude, Intermediates
137	Central Tank Farm	Intermediates, Aromatics
138, 831, 833	Heavy Oil Tank Farm	Lubricants, Grade A Crude
430, 432	Environmental	Wastewater, Sour Water
930, 933, 934, 935, 940	Aromatics Recovery Complex	Aromatics

2.2.3 Secondary Containment

For bulk storage tanks and oil-filled operational equipment located within process areas north of Lawndale and not adjacent to a property boundary, public area, or navigable waterway, HRO utilizes the facility drainage systems and surface impoundments to control potential oil releases as specified in §112.8(b). For bulk storage tanks and oil-filled operational equipment adjacent to a property boundary, public area, or navigable waterway, HRO utilizes the facility drainage system as described above or has designed secondary

containments to contain the volume of the largest tank in the containment plus sufficient freeboard for precipitation as specified in §112.8(c). Construction materials are either earthen dikes or concrete walls which are sufficiently impervious to contain a catastrophic release of oil. A common industry standard is to use either a 24 hour rainfall amount associated with a 25 year rain event or 110% of the largest tank in the containment. A list of Oil-Filled Electrical Equipment in the facility is provided in [Table 2-4](#), the Cathodic Protection Rectifier Location Plan is provided in [Figure 2-3a](#), and Contractor Oil Storage Locations are illustrated in [Figure 2-3b](#).

Estimates of volumes contained by tank basins adjacent to a property boundary, public area, or navigable waterway are based on areas and dike height obtained from an aerial topographic survey conducted in May 2011 and partially from a dike survey conducted in 2001 by Parsons Energy and Chemicals Group Inc. The volume calculation for secondary containment is based 110% of the largest tank in the containment and includes the available volume below the lowest point of the diked containment.

Some secondary containment perimeters contain low interior dikes lying close to individual tanks or groups of tanks. These low tank dikes were not considered the basin boundaries. The secondary containment perimeters satisfy the regulations for the largest tank within the containment area. A tank containment basins summary is provided in [Table 2-5](#).

The design of tank dike walls conforms to National Fire Protection Association codes and Occupational Safety and Health Administration (OSHA) standards. Based on the soils types, drainage records, and field observations, secondary containment areas are sufficiently impervious to contain a discharge from an aboveground facility with line of sight inspection capability (tanks, containers, piping, etc.) until clean up occurs. A summary of secondary containment areas for bulk storage tanks is provided in [Table 2-6](#).

Aboveground tanks within secondary containment are subjected to integrity testing every 20 years and when major repairs are performed. The integrity testing takes into account the tank design (i.e., floating roof, fixed roof, etc.), material stored, and the intended operation. As appropriate at the time of the test, integrity testing techniques may include hydrostatic testing, radiographic testing, visual inspections, ultrasonic testing, acoustic emission testing, or a system of non-destructive shell testing. Comparison records are kept, and tank support and foundation documents are included in these inspection records.

The Secondary Containment systems are inspected against the following checklist:

Dike or Berm System

- ✓ Level of precipitation in dike/available capacity
- ✓ Operational status of drainage valves
- ✓ Dike or berm permeability
- ✓ Debris

- ✓ Erosion
- ✓ Permeability of the earthen floor of diked area
- ✓ Location/status of pipes, inlets, drainage beneath tanks, etc.

Secondary containment

- ✓ Cracks
- ✓ Discoloration
- ✓ Presence of spilled or leaked material (standing liquid)
- ✓ Corrosion
- ✓ Valve conditions

Retention and drainage ponds (as applicable)

- ✓ Erosion
- ✓ Available capacity
- ✓ Presence of spilled or leaked material
- ✓ Debris
- ✓ Stressed vegetation

Several tanks at the refinery are heated to ensure adequate viscosity of the stored material. Steam condensate from internal heating coils is collected and rerouted to either the boiler feed water system or the wastewater treatment system. Effluent from the facility wastewater collection system is visually observed at least once every 4 hours for indications of possible upsets (e.g., a floating phase).

Area operators conduct visual inspections of bulk storage tanks, secondary containment dike walls, and dike valves during the normal course of their duties. When deficiencies are found, operators write work notifications for repairs. In addition, equipment leaks or spills are immediately reported to the Shift Management Team so appropriate clean-up and repairs can be initiated.

Operators maintain communications with each other via radio when pumping materials and drawing water from tanks. When drawing water to wastewater systems (e.g., OWS or NESHAP), the operator is in attendance at the water draw continuously, never leaving the water draw unattended, in order to continuously monitor the material being drained and any sump levels, as they may apply. The operator will close the water draw valve before leaving the area if called away.

2.2.4 Aboveground Fuel Storage Tanks

(b) (7)(F), (b) (3)

The tanks primary containment is a monolithic vault constructed of continuous and seamless concrete with no cold joints or heat sinks on the bottom or sides.

The tanks secondary containment consists of a 30 mil high-density polyethylene membrane protected by exterior concrete. These tanks are located at the north end of the Maintenance Shop and Store House. The two tanks replaced two underground storage tanks that were emptied and removed from the facility in February 2007. The Facility does not have completely or partially buried metallic storage tanks or bunkered metallic tanks for the storage of oil.

2.3 PIPELINES

Buried pipelines are wrapped and coated to reduce corrosion, and cathodic protection is provided where appropriate. Buried pipelines, which have been exposed for any reason, are periodically inspected for deterioration and appropriate action taken. Pipe supports are designed and constructed of steel or concrete independently supported by concrete foundations, are designed to appropriate engineering standards for minimizing abrasion and corrosion, and allow for expansion and contraction. Drivers of vehicles granted entry into the plant are routinely cautioned regarding safe practices. There is no leak detection system on the pipelines.

Pipelines that contain oil are capped at all unused terminal locations and are either tagged with "Line in Service" signs or blinded. Pipeline terminal connections are blank flanged when:

- ✓ It is necessary to isolate leaks,
- ✓ Maintenance requirements dictate opening some in line equipment, or
- ✓ It is necessary to isolate and clear a vessel to which the pipeline is connected.

As defined by §49 CFR 194.5, HRO has designated its "Response Zone" as the refinery facility plus the "line sections" owned or operated by HRO which are not protected by secondary containment or the refinery drainage system including but not limited to those lines which run off site to other locations. A complete listing of these line sections is provided in [Table 2-7](#). These lines connect the 225 Tank Farm via a tunnel under State Highway 225. [Figure 2-4](#) shows the locations of HRO's designated line sections.

2.4 VESSEL DATA AND DOCK INFORMATION

[Figure 2-2](#) shows the locations of all mooring areas and transfer locations at HRO. The refinery has four berths, designated as "Dock A," "Dock B," "Dock C," and "Dock D." These facilities can accommodate vessels ranging in size from a "lightered" (450,000 bbl), 80,000 dead weight tons (550,000 bbl) tanker at Dock B to 5,000 bbl barges.

Because of the shallow water (approximately 15 feet), Dock A services only barges. The six loading arms (two 10-inch arms, four flinch arms) permit transfer of crude oil, fuel oils and

aromatics. Secondary containment for Dock A is provided by a sump located at the block valves to the dock; additional secondary containment is provided by the Dock Road, which is curbed and drains to HRO's surface impoundments. Also, Dock A has a concrete base, with six-inch curbs, which drains by underground line to the sump. Rainfall and/or spills can also drain to the Dock Road.

Dock B, which is off the channel and in the Clinton Island Turning Basin, handles the largest ships (38 feet) at the refinery. Dock B has seven loading arms (two 12-inch arms, three 10-inch arms, two 8-inch arms) for crude oil, fuel oils, lube oils, and aromatics. A sump located at the block valves to the dock provides secondary containment for Dock B; the Dock Road, which is curbed and drains to HRO's internal storm water basins, provides additional secondary containment. Also, Dock B has a concrete base, with six-inch curbs, which drains by underground line to the sump. Rainfall and/or spills can also drain to the Dock Road.

Because Dock C is on the channel (north of the C&P Building), wide ships would extend into the channel; therefore, the berth has restrictions on the ship's beam. This dock can move aromatics, lube oils, crude oil, and fuel oils. The dock has 11 loading arms (one 12-inch arm, ten 6-inch arms) and seven hoses. Secondary containment for Dock C consists of a concrete pad with curbs ranging in height from six inches to twelve inches. This curbed area drains by underground pipeline to a large sump that receives drainage from the sumps along Dock Road; from this sump, material is pumped to HRO's wastewater treatment area.

Sulfur (molten) is loaded into barges at Dock D, which is east of Dock C. Some products to the docks have dedicated lines (restricted to a particular service). Multiple service lines require line displacements to protect product quality.

Flow to and from the docks is controlled by block valves located at the end of the loading arm (pneumatic), the manifold to the loading arms (pneumatic), the end of the pipe before the manifold (main block valve, manually operated) the pumps (manual or motor operated gate valve) one each for the suction and discharge, and the discharge or receiving tank outlet (manual or motor operated gate valve). The pneumatically actuated valves are for emergency shutdown situations and can be closed quickly. The location of these valves are depicted in [Figure 2-5](#), [Figure 2-6](#), [Figure 2-7](#), and [Figure 2-8](#). Residual material in each loading arm is drained into a "closed" dry slop containment sump and subsequently pumped to the slop oil system for reprocessing. Each loading arm and the transfer piping system must not leak under static liquid pressure at least 1.5 times the maximum allowable working pressure. The USCG granted approval for alternate compliance to §33 CFR 156.170(c)(4) as indicated in [Figure 2-9](#) such that testing of the transfer piping system need only be performed back to the first block valve on shore.

2.5 SITE DRAINAGE INFORMATION

At HRO, extensive curbing, surface grading, and underground piping directs potentially contaminated surface runoff, process unit wastewater, and tank water draws into the plant oily water treatment system. Block valves that remain in the closed position until opened to drain storm water control drainage from diked oil storage areas. Oil spilled or leaked within the dikes is contained and then removed by vacuum trucks. Storm water runoff from the diked areas is drained through the plant's two storm water sewer systems. Drainage from un-diked areas flows through the same sewer systems.

The drainage watershed within the refinery can be divided into the west drainage area and the east drainage area. Storm water runoff from the rainfall events within the west drainage area is collected and impounded in the West Guard Basin (WGB) and West Impoundment Basin (WIB). Runoff within the east drainage area is impounded in Dock B (No. 4) Guard Basin, C&P Guard Basin, East Guard Basin (EGB) and the East Impoundment Basin (EIB).

Under conditions of moderate rainfall, storm water is retained within the respective Impoundment and Guard basins only until it can be pumped to storm water storage tanks where any oil will be separated from the storm water. The storm water is then pumped to Gulf Coast Authority (GCA) Washburn Tunnel facility for further primary and secondary treatment and disposal.

If an overflow of the basin becomes imminent during a heavy rainfall event (four inches/hour), underflow weirs are provided to divert water from the basins directly to the Houston Ship Channel. These underflow weirs should retain any oil that may be in the storm water retention Guard Basins. The discharges from the three emergency storm water outfalls are regulated by a TPDES permit. Storm water that overflows from the WGB goes to Outfall 003. Storm water overflow from the EGB goes to Outfall 001. Storm water overflow from the Old GCA Sump goes to Outfall 002. Flow measurements and samples are taken during a storm water discharge event in order to provide a record of the quantity and quality of water discharged as required by the discharge permit.

Oil retaining booms will be deployed to contain oil sheens that may reach the ship channel, and vacuum trucks are utilized to recover the oil, if any.

2.6 IDENTIFICATION OF FACILITIES

Several facilities are used for transferring, shipping, or receiving petroleum or other products at HRO. Some loading/unloading areas are not required to be in the Plan (for example: the Sulfur Loading Rack) but were included due to their proximity to other loading areas. Concerning all highway and railway related transportation; the Refinery Secondary Containment System protects the following loading/unloading areas:

- ✓ Tank car Loading rack (TCLR), Tracks 1 and 2
- ✓ Tank truck loading rack, west of TCLR
- ✓ Tufflo tank truck rack (west of former MEK Unit)
- ✓ Tufflo tank car loading rack (southeast of former NMP Unit)
- ✓ Sulfur tank truck loading rack (east of TCLR)
- ✓ Tank Truck Loading Rack (south of Tank 678)
- ✓ Ship loading/unloading facility (Docks A, B, C and D)
- ✓ ARU Loading Rack (west side)

2.6.1 Loading and Unloading Operations

Spill control procedures for loading and unloading operations are discussed in more detail in Section 3 of this Plan.

Docks

All spillage on the docks is contained and handled through wet and dry sloop systems. In the event of a spill on water, spill booms are deployed and vacuum trucks are used for cleanup. Cleanups are handled by HRO personnel and contractors for quick and effective treatment. Standard Operating Procedures for loading and unloading barges and ships are maintained electronically at in LiveLink.

Tank Car/Truck

Prior to loading or unloading, tank cars and trucks are first spotted in the appropriate location and are secured by either setting the brake or wheel chocks on each side of the wheel or both. Drivers are not allowed in their vehicle during loading or unloading. The car or truck is not allowed to leave the spotted location until all disconnections have been made, and all safety chains have been removed and outlets have been checked for leakage. Loading rack containment is adequate to contain the largest compartment of any truck or tank car using the truck rack or rail rack, respectively. In addition, the loading rack is equipped with an automatic shutdown system and warning signs are posted at the rack.

2.6.2 Transfer Operations

Pipelines, which can contain oil, are capped at all unused terminal locations and are either tagged With "Line in Service" signs or blinded. Pipeline terminal connections are blank-flanged when:

- ✓ It is necessary to isolate leaks,
- ✓ Maintenance requirements dictate opening some in-line equipment, or

- ✓ It is necessary to isolate and clear a vessel to which the pipeline is connected.

Operations personnel in the course of their normal duties routinely check all above ground valves and piping.

2.7 SITE SECURITY

(b) (7)(F), (b) (3)

2.8 COMMUNICATIONS

Communication is essential to an efficient emergency response program. During a spill, communications control center will be established at the Emergency Operations Center in the eastern portion of the second floor of the Administration Building. The procedures in the EAP are then activated.

Communications are a critical element of the Emergency Response Team's (ERT) effort. The IC must have immediate communication with the Field Coordinator, ERT Operations Chief, HSSE Environmental and Safety Coordinators and with supporting units and organizations. While communications personnel and the systems they operate are not a part of the ERT, they are essential in supporting the Emergency Response efforts. A discussion of the responsibilities of the communications control center and resources of the communications control center is detailed in the [EAP](#).

2.9 INSPECTION AND RECORDS

Appropriate records are maintained covering key points of this program. Spill events are documented and the records are kept in the HRO Environmental Library. Records of tank integrity tests and inspections are maintained with the inspection procedures in the Inspection Department. Inspection records and are maintained for a period of 5 years.

2.10 ENVIRONMENTAL PERMITS

The environmental permits and authorizations for air, water, solid/hazardous waste and spill response for the HRO are summarized in [Table 2-8](#).

Table 2-8 Environmental Permits and Authorizations

Permit Type	Permit No.	Agency	Purpose	Effective Date
NSR	2167	TCEQ	State operating permit	08/19/10
Site ID	TXD08268897	EPA	Offsite disposal of hazardous waste	NA
Site ID	30092	TCEQ	Solid waste registration number for offsite disposal or solid and/or hazardous waste	NA
Title V	O-01372	TCEQ	Federal operating permit	03/12/12
TPDES	W0000392000	TCEQ	Wastewater discharge to Houston Ship Channel	01/13/10
RCRA Part B	HW-50106	TCEQ	Operating permit for closure of land treatment units	05/02/11
SRPP	20320	Texas GLO	OSPR Discharge Prevention and Response Certificate	07/29/13
SRPP	FRP-06-TX-00040	EPA	Statutory approval of SRPP	02/08/08
SRPP	Control No 93043	USCG	Approval of SRPP	10/07/13
Affluent	401/601	GCA	Wastewater Effluent Permit	10/27/11

Note: There are no pre-approved uses of chemical agents for inland or near shore environments. Authorization of in-situ burning is subject to State and Regional Response Team approval.

3.0 SPILL RESPONSE PROCEDURES

This section of the Plan describes how HRO will respond to spills that occur at the facility. These spills can be land-based within the refinery resulting from a variety of operations including, but not limited to, tank or pipeline liquid releases or from liquid spills to the water at HRO's Marine Terminal. As stated earlier, the EAP contains all of the pertinent information for reporting and responding to an emergency condition, which includes spills. This section discusses spill response in more detail.

3.1 STANDARD OPERATING PROCEDURES FOR ONSHORE SPILLS

The [EAP](#) contains procedures for the notification and response to spills. The EAP specifies the Security Operations Center (SOC) must be notified of any incident or emergency, regardless of the nature. Based on severity of the incident or emergency, the SOC may activate the Emergency Notification System which includes a plantwide tone-out system, public address system, and ERT call-out via a pager system. The internal notification and level of training for ERT personnel is provided in [Table 3-1](#).

The SOC will activate the EAP if there is the possibility of explosion or fire, or if hazardous materials spills have been released. Hazardous Material (HAZMAT) spills are responded to by the ERT and directed by a HAZMAT officer for all Alert levels. The Emergency Notification and Response Procedure is presented in [HSE-EAP-002](#). The overall ERT Command Structure and Operations Structure are illustrated in [Figure 3-1](#) and [Figure 3-2](#), respectively.

Table 3-1 Internal Notification References

INTERNAL NOTIFICATIONS - GENERAL FACILITY			
FACILITY	ADDRESS	OFFICE	FAX NUMBER
Houston Refining LP	12000 Lawndale Houston, Texas 77252-2451	713-321-4111 713-321-4211 (SOC)	713-321-4700

INTERNAL NOTIFICATIONS - LOCAL RESPONSE TEAM				
POSITION/TITLE	RESPONSE TIME	TRAINING LEVEL	CONTACT NUMBER	SPILL EVENT RESPONSIBILITY
Plant Shift Superintendent / QI*	Immediate 1-On Duty/Shift On-Site 24/7	HAZWOPER Operations Level Plant/Field Coord. Training (Includes QI Training)	713-321-4223 – Office 713-321-4211 – SOC	Plant Coordinator
First Line Supervisor / Alternate QI*	Immediate 1 -On Duty/Shift On-Site 24/7	HAZWOPER Operations Level Plant/Field Coord. Training (Includes QI Training)	713.321-5374 – Office 713-321-4211 – SOC	Field Coordinator
Emergency Response Team (ERT) - Officers* Shift Commander and other ERT Officers	Immediate 1 On Duty/Shift On-Site 24/7	HAZWOPER Incident Command Level	713-321-4211 – SOC	Shift Commander (Incident Command) Other officers ICS positions as required.
Chief Officers: Chief Assistant Chief	Respond To Callout When Not On Shift	HAZWOPER Incident Command Level	713-321-4211 – SOC	Incident Command or other ICS positions as required
Emergency Response Team (ERT)	Immediate 10 - On Duty/Shift On-Site 24/7 Respond To Callout When Not On Shift	HAZWOPER Hazmat Tech Level Firefighter/Hazmat Techs	713-321-4211 – SOC	Emergency response services to include supporting Marine Spill Team
ERT Marine Spill Team Personnel	Immediate 3 - On Duty/Shift On-Site 24/7 Respond To Callout When Not On Shift	HAZWOPER Hazmat Tech Level Firefighter/Hazmat Techs	713-321-4211 – SOC	Emergency marine spill response

* All of these positions are manned 24 hours per day, and any of these personnel can be reached through SOC at (713) 321-4211 at any time.
Other specific training for individuals is maintained at the facility.

Figure 3-1 Emergency Response – Command Structure

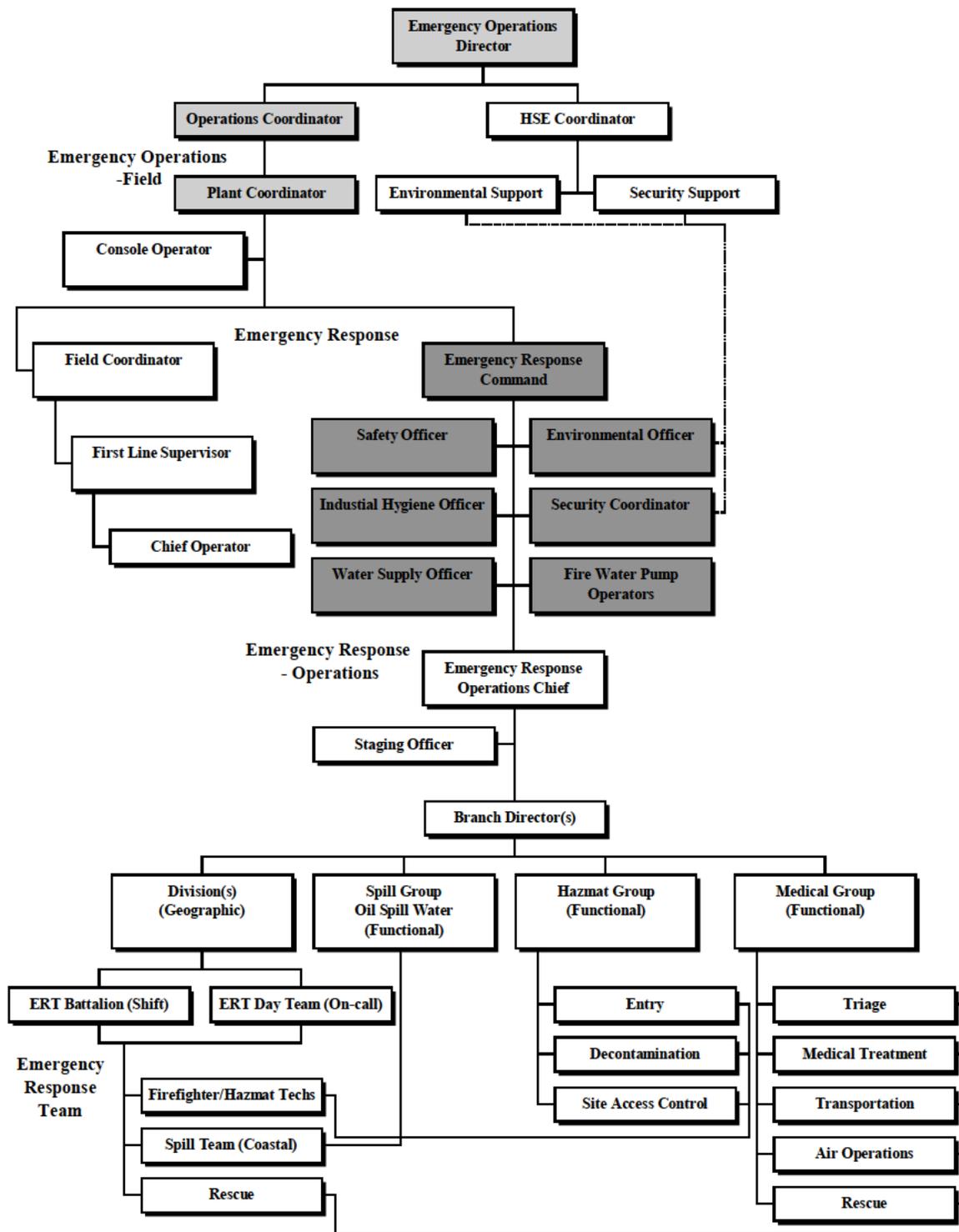
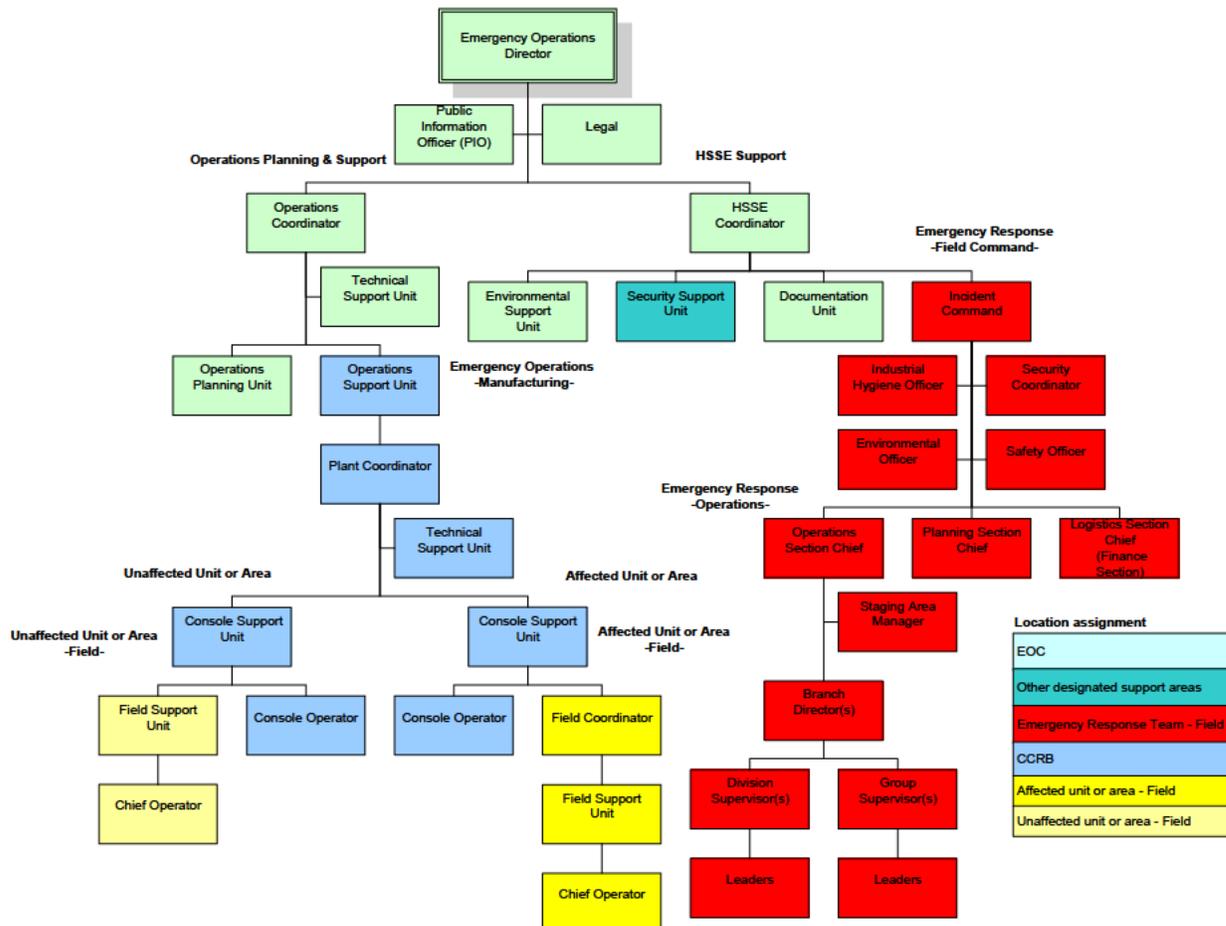


Figure 3-2 Emergency Operations Structure



Location assignment

EOC
Other designated support areas
Emergency Response Team - Field
CCRB
Affected unit or area - Field
Unaffected unit or area - Field

3.2 EMERGENCY ACTION PLAN

The [EAP](#) is a separate document that communicates the procedures that represent a safe and effective approach to emergency response for this facility. The EAP provides for:

- ✓ An organization capable of managing the response effort and marshaling the necessary resources to deal with the emergency,
- ✓ An efficient means of notifying the appropriate ERT members of the emergency, thereby enabling them to respond quickly with proper equipment;
- ✓ Systematic emergency response training;
- ✓ Comprehensive procedures to be followed by Emergency Operations Center (EOC), ERT, Operations, and non-essential personnel in the event of an emergency; and
- ✓ Provision for efficiently utilizing outside assistance when necessary.

The EAP identifies the personnel that are on-call by job title. The SOC has an up-to-date call-out list with home phone numbers and pager numbers to contact to initiate an emergency action at any time of the day.

3.3 SPECIAL CASE: MARINE SPILLS

HRO has three docks on the Houston Ship Channel that can load or unload petroleum feedstock, intermediates or finished products. HRO has specially trained Spill Team that provides immediate response to a spill to water. The objective of the Spill Team is to contain the spill at the dock area. Outside contractors will provide clean-up and additional equipment as needed.

3.3.1 Spill Response Team

The Spill Team consists of a QI, and the duties of the Spill Team are described below. These duties are specific to Marine spill situations after an Alert 1 has been initiated, per the EAP. Other duties are given in the EAP for other command and support personnel.

- ✓ Assess the spill and decide on the response actions required.
- ✓ Operate the spill boat.
- ✓ Deploy boom and contain the spill.
- ✓ Clean-up and/or dispose of contaminated equipment or material, as necessary.
- ✓ Call out one or more spill response service contractors to contain and clean-up the spill.

3.3.2 Outside Contractors

HRO personnel provide the initial spill containment response and some degree of clean-up for marine spills. However, HRO relies on outside contractors to provide material and manpower for complete spill containment, removal of floating spillage, and clean-up of affected areas. HRO is a member of the Clean Channel Association (CCA) which provides worst-case spill response capability, specialized equipment, as well as HAZWOPER and ICS training for its members. In addition, HRO has a service contract with Garner Environmental Services to assist and respond to marine spills.

Both CCA and Garner Environmental are certified Oil Spill Response Organization (OSRO) as indicated by the OSRO certifications provided in [Figure 3-3](#) and [Figure 3-4](#), respectively. The Field Coordinator may request assistance from these outside contractors when a spill is beyond the capability of ERT personnel. In non-emergency situations, HRO's Solid Waste Coordinator makes the determination and directs the clean-up.

In accordance with the USCG Final Rule (FR Vol. 74, No. 167) dated August 31, 2009, certain facilities must identify in their response plan and ensure the availability of through contract or other approved means, dispersant application resources and aerial oil tracking capability. The requirement for dispersants is limited to facilities that operate in preauthorized areas. For this COTP zone, preauthorized area is defined as at least 3 nautical miles offshore and in at least 33 feet of water. Therefore, this Facility is currently operating outside the designated preauthorized area and is not required to amend the plan to address the dispersant requirements.

Additionally, the Rule states that facilities operating exclusively on "inland rivers" are not required to comply with the new aerial observation requirements. Coast Guard Headquarters has determined that "inland rivers," as used in the CAPS Final Rule, is equivalent to the term "inland area," which is defined in 33 CFR 154.1020 as "the area shoreward of the boundary lines defined in 46 CFR Part 7..." Therefore, the Facility is currently operating within an "inland river" and is not required to amend the plan to address aerial oil tracking requirements. However, if aerial oil tracking is required during a response, either through CCA or Garner Environmental Services access to aerial surveillance will be provided.

3.3.3 Other Governmental Agencies

In the event of a catastrophic spill resulting in potential impacts to the community, LEPCs and other governmental agencies may be called to assist the HRO with managing emergency responses. Because LEPCs understand the chemical hazards throughout the community, they have developed emergency plans in case of accidental releases which are

designed to help communities prepare for and respond to emergencies involving hazardous substances. A listing of local governmental agencies is provided in [Table 3-2](#).

3.3.4 Logistics

As illustrated in Figure 3-2, the Finance Section of HRO's Emergency Operations Command Structure falls under the Supply Unit in the Logistics Section. The primary responsibility of the Logistics Section Chief is to assemble on-site or corporate purchasing and procurement staff as necessary to support emergency responses. The Logistics Section Chief is also responsible for managing all financial aspects of an incident, tracking and documenting all costs and resources, verification and payment of contractor services, and providing financial input to demobilization planning.

3.4 NOTIFICATION REQUIREMENTS

In addition to local governmental agencies, the National Response Center, Texas Commission on Environmental Quality, Texas General Land Office, US Fish and Wildlife Service, and/or other Federal and State agencies may need to be notified. The contact information for Federal, State, and local regulatory agencies and emergency services is also presented in [Table 3-2](#). Either the Emergency Operations Coordinator or a designated EOC Staff person will coordinate response efforts with the designated Federal, state and/or local On-Scene Coordinator.

Depending the level and severity of emergency, additional HRO support may need to be called in. These support groups include Human Resources, Public Information personnel, Insurance Adjustment (Risk Management) coordinator, and other refinery support teams. These efforts will be consistent with the ACPs Unified Command System.

Table 3-2 External Notification References

GOVERNMENTAL EMERGENCY NOTIFICATION/ADVISORY (CALL 911 IN CASE OF EMERGENCY)			
Service	Location	Office	Alternate
City of Houston Municipal Water Supply	Houston, TX	(713) 837-0311	
City of Pasadena Fire Department	Pasadena, TX	(713) 473-2273	
City of Pasadena LEPC	Pasadena, TX	(713) 473-2273	
City of Pasadena Ambulance Service	Pasadena, TX	(713) 472-1911	
City of Pasadena Water Department	Pasadena, TX	(713) 475-5566	
City of Pasadena Fire Marshal's Office	Pasadena, TX	(713) 475-5556	
City of Pasadena City Marshal's Office	Pasadena, TX	(713) 475-5559	
F.B.I. – Houston	Houston, TX	(713) 693-5000	
Harris County Sheriff	Houston, TX	(713) 221-6000	
Texas Department of Public Safety	Houston, TX	(281) 517-1300	
Gulf Coast Authority – Washburn Tunnel Facility	Pasadena, TX	(713) 472-5507	(713) 648-2373 (pager for Greg Seay)
Texas Commission on Environmental Quality	Houston, TX	(713) 767-3563	(713) 767-3561 (fax)
EPA Region 6 Spill Line	Dallas, TX	(800) 832-8224	
National Response Center (NRC)	Washington, DC	(800) 424-8802	
USCG Sector Houston - Galveston	Houston, TX	(713) 671-5105	
Texas General Land Office	La Porte, TX	(800) 832-8224	
OUTSIDE ASSISTANCE/ADVISORY NOTIFICATIONS			
Company	Location	Office	Alternate
CenterPoint Energy	Houston, TX	(281) 894-0491	
Southwestern Bell Telephone Company	Houston, TX	(800) 286-8343	
KHOU – TV (CBS)	Houston, TX	(713) 521-4384	
KPRC – TV (NBC)	Houston, TX	(713) 778-4910	
KTRK – TV (ABC)	Houston, TX	(713) 666-0713	
KRIV – TV (FOX)	Houston, TX	(713) 479-2600	
KTRH Radio	Houston, TX	(713) 212-8000	
KPRC Radio	Houston, TX	(713) 212-8000	
KILT Radio	Houston, TX	(713) 881-5170	
Infinity Radio Houston (KILT)	Houston, TX	(713) 881-5957	
Weather Report	Houston, TX	(281) 337-5074	

Table 3-2 External Notification References, continued

LOCAL MEDICAL EMERGENCY SERVICES			
Service	Location	Office	Alternate
Rural/Metro Ambulance	Pasadena, TX	(713) 472-1911	
Columbia Bayshore Medical Center	Pasadena, TX	(713) 359-1440	
Memorial Hermann Southeast	Pasadena, TX	(281) 929-6100	
Kindred Hospital	Pasadena, TX	(713) 473-9700	
Hermann Hospital	Houston, TX	(713) 704-4000	(713) 704-7284

WILDLIFE ASSISTANCE/ADVISORY NOTIFICATIONS			
Company	Location	Office	Alternate
Wildlife Center of Texas (24 Hrs) (Sharon Schmalz)	League City, TX	(281) 332-8319	(713) 279-1417 (Pager) (713) 643-9453 (Menu)
Texas Parks & Wildlife Department (24 Hrs) (Law Enforcement Center)	La Porte, TX	(281) 842-8100	(281) 842-8404 (Fax)
Texas Parks & Wildlife Department (Local Field Office - South)	Houston, TX	(713) 779-8977	(713) 779-7742 (Fax) (281) 931-6471 (North)
U.S. Fish and Wildlife Service (Ron Brinkley)	Houston, TX	(281) 286-8282	(281) 488-5882 (b) (6) (Cell)

USCG CLASSIFIED OIL SPILL REMOVAL ORGANIZATIONS (OSRO)			
Company	Location	Office	Alternate
Garner Environmental Services, Inc.	Deer Park, TX	(800) 424-1716	(281) 930-1200
Clean Channel Association (CCA)	Houston, TX	(713) 534-6195	
Administrative Director: (Phil Glenn)	Houston, TX	(713) 534-6195	(713) 534-6197 (Fax) (b) (6) (Home) (b) (6) (Mobile)
Equipment and Maintenance Supervisor: (Steven Bigby)	Houston, TX	(713) 534-6195	(713) 534-6197 (Fax) (b) (6) (Home) (b) (6) (Mobile) Nextel ID: 142*54*11950
Administrative Assistant: (Karen Storm)	Houston, TX	(713) 534-6195	(713) 534-6197 (Fax) (b) (6) (Home) (b) (6) (Mobile)



Table 3-3 Notification Data Sheet

Date: _____ Time: _____

INCIDENT DESCRIPTION

Reporter's Full Name: _____ Position: _____
 Day Phone Number: _____ Evening Phone Number: _____
 Company: _____ Organization Type: _____
 Facility Address: _____ Owner's Address: _____

Facility Latitude: _____ Facility Longitude: _____

Spill Location: _____
 (if not at Facility) _____

Responsible Party's Name: _____ Phone Number: _____

Responsible Party's Address: _____

Source and/or cause of discharge: _____

Nearest City: _____

County: _____ State: _____ Zip Code: _____

Section: _____ Township: _____ Range: _____

Distance from City: _____ Direction from City: _____

Container Type: _____ Container Storage Capacity: _____

Facility Oil Storage Capacity: _____

Material: _____

Total Quantity Released	Water Impact (YES or NO)	Quantity into Water

Weather conditions on scene: _____

RESPONSE ACTION(S)

Action(s) taken to Correct, Control, or Mitigate Incident: _____

Number of Injuries: _____ Number of Deaths: _____

Evacuation(s): _____ Number Evacuated: _____

Damage Estimate: _____

More information about impacted medium: _____

CALLER NOTIFICATIONS

National Response Center (NRC): 1-800-424-8802

Additional Notifications (Circle all applicable): USCG EPA State OSHA Other

NRC Incident Assigned No. _____

ADDITIONAL INFORMATION

Any information about the incident not recorded elsewhere in this report: _____

NOTE: DO NOT DELAY NOTIFICATION PENDING COLLECTION OF ALL INFORMATION.

3.5 RESPONSE PERSONNEL

3.5.1 Qualified Individual

The QI and alternate QIs are listed in [Table 3.1](#). The QI is referred to as the Emergency Operations Coordinator, and all QIs and Alternate QIs must be:

- ✓ Able to speak fluent English;
- ✓ Available on a 24-hour basis by either pager, telephone or cellular phone and can arrive at the HRO facility in a reasonable time;
- ✓ Familiar with the implementation of the SRPP; and
- ✓ Trained in the responsibilities of the QI under the SRPP.

The QI and alternate QI s identified in the Plan have the full authority to:

- ✓ Activate internal alarms and hazard communication systems to notify all facility personnel (see [EAP](#));
- ✓ Notify all response personnel, as needed;
- ✓ Identify the character, exact source, amount and extent of the release, as well as the other items needed for notification;
- ✓ Notify and provide necessary information to the appropriate Federal, State and local authorities with designated response roles. Act as liaison with the pre-designated Federal On-Scene Coordinator;
- ✓ Assess the interaction of the spilled substance with water and/or other substances stored at the facility and notify response personnel at the scene of that assessment;
- ✓ Assess the possible hazards to human health and the environment due to the release. This assessment must consider both the direct and indirect effects of the release;
- ✓ Assess and implement prompt removal actions to contain and remove the substance released;
- ✓ Coordinate rescue and response actions as previously arranged with all response personnel;
- ✓ Obligate HRO funds required to carry out response activities; and
- ✓ Direct cleanup activities until properly relieved of this responsibility.

The QI and Alternate QI(s) may draw upon the input and knowledge of other facility and response personnel to help them respond to a spill in a timely manner.

3.5.2 Emergency Response Personnel

HRO developed the [EAP](#) based on the Incident Command System model. The ERT is an organized group of HRO refinery personnel who are equipped to handle all types of emergencies. During an emergency, the EOC is staffed with a team of specialists and managers to assist the Emergency Operations Coordinator (the QI).

The Emergency Operations Coordinator directs the ERT and EOC during an incident. Trained ERT personnel assume specific roles in either of these two areas. The ERT personnel respond to the incident in the notification functions from a Central Command Center. [Figure 3-1](#) and [Figure 3-2](#) illustrate the ERT Command Structure and Operational Structure. The Emergency Operations Organization roles and responsibilities are outlined in [HSE-EAP-005](#).

3.5.3 Contractor Response Personnel

Spill response activities performed by contract response personnel are managed and coordinated by the Emergency Operations Coordinator or his designee. A copy of the CCA Resource Manual is presented in [Figure 3-5](#), and the Garner Environmental Response Rate Schedule is provided in [Figure 3-6](#).

3.6 RESPONSE EQUIPMENT

3.6.1 On-site Equipment

The facility-owned response equipment is inspected per regulations using the appropriate company response equipment inspection checklist(s). Inspection records are maintained on file for a minimum of five (5) years. Spill response equipment owned and operated by HRO is listed in [Table 3-4](#).

3.6.2 Contractor Equipment

As indicated in [Section 3.3.2](#), CCA and Garner Environmental are OSRO-certified spill contractors available to HRO to assist with clean-up of spills. Spill response equipment owned and operated by CCA is listed in [Figure 3-7](#), and Garner Environmental Services spill response equipment is listed in [Figure 3-8](#).

In addition to spill response equipment owned and operated by HRO, CCA, and Garner Environmental Service, the Texas GLO has staged equipment located throughout the state for spill response. The locations of Texas GLO staged equipment in close proximity to HRO is illustrated in [Figure 3-9](#).

Table 3-4 HRO Emergency Spill Response Equipment

Equipment	Description	Operational Check	Location / accessibility
Oil Boom	1500' 18" conventional oil containment boom	Once per quarter	1250' - Spill Response Facility
Oil Boom		Once per quarter	250' - Boom Box between B and C Dock
Oil Boom		Once per quarter	250' - Boom Box between C and D Dock
Spill Boats	1-16' flat bottomed boat and 1-21' flat bottomed spill boat.	Once per quarter	16' boat located in Spill Response Facility (NE corner of refinery) and 21' boat located in No. 5 Barn
Vacuum Truck - 1989 Freightliner / Cusco, truck No. 6135	70 - barrel capacity	Trucks are used daily for various purposes.	Leased from Veolia
Vacuum Truck - 1990 International/Cusco, truck No. 3335	70 - barrel capacity	Trucks are used daily for various purposes	Leased from Veolia
Vacuum Truck - 1991 International/Cusco, truck no. 6008	70 - barrel capacity	Trucks are used daily for various purposes	Leased from Veolia
Vacuum Truck - 2002 International, truck no. 6189	Liquid Ring Ace	Trucks are used daily for various purposes	Leased from Veolia
Absorbents - Spill Textiles.	Assorted Sorbent Booms & Pads	Once per quarter	East Staging Building, Waste Crew Truck, 7 Hazmat Trailer
Absorbents	Sorbent Granules	Once per quarter	East Staging Building, Waste Crew Truck, 7 Hazmat Trailer
Power Generator	PTO-Driven	Once per quarter	Rescue Truck R-1, Cascade Truck C-1
900 MHz Motorola Radios, MTS2000 Smartnet Trunked Portable Radio, Model HOIQX/207H,	5 - Plant Frequency	Radios are used daily and replaced as needed.	HSE Communications Equipment Cabinet
Lighting	Light Towers	Once per quarter	Rescue Truck R-1, Cascade Truck C-1
Respirators - Scott SCBA Masks	50 - Small, medium, large	Once per quarter	Cascade Truck
Respirators - 4.5 Scott Ready to Use	36	Once per quarter	Cascade Truck
Ready to Use Scott Bottles	36	Once per quarter	Cascade Truck

3.7 DETERMINING SPILL FLOW DIRECTION IN HOUSTON SHIP CHANNEL

The following information can be used for determining probable spill direction in the Houston Ship Channel. The Emergency Management Coordinator shall be responsible for providing up-to-date accurate weather information to the Severe Weather Management Team. Also, employee emergency and severe weather information is available by calling phone number (713) 321-5775.

Wind Direction and Speed:

Real-time wind direction and velocity is obtained from the HRO Weather Station read-out located in the SOC. Based on the measured wind direction and velocity, the speed at which an oil slick moves on the surface of water is estimated at about 3.4% of the wind velocity.

Ship Channel Current and Tide Direction:

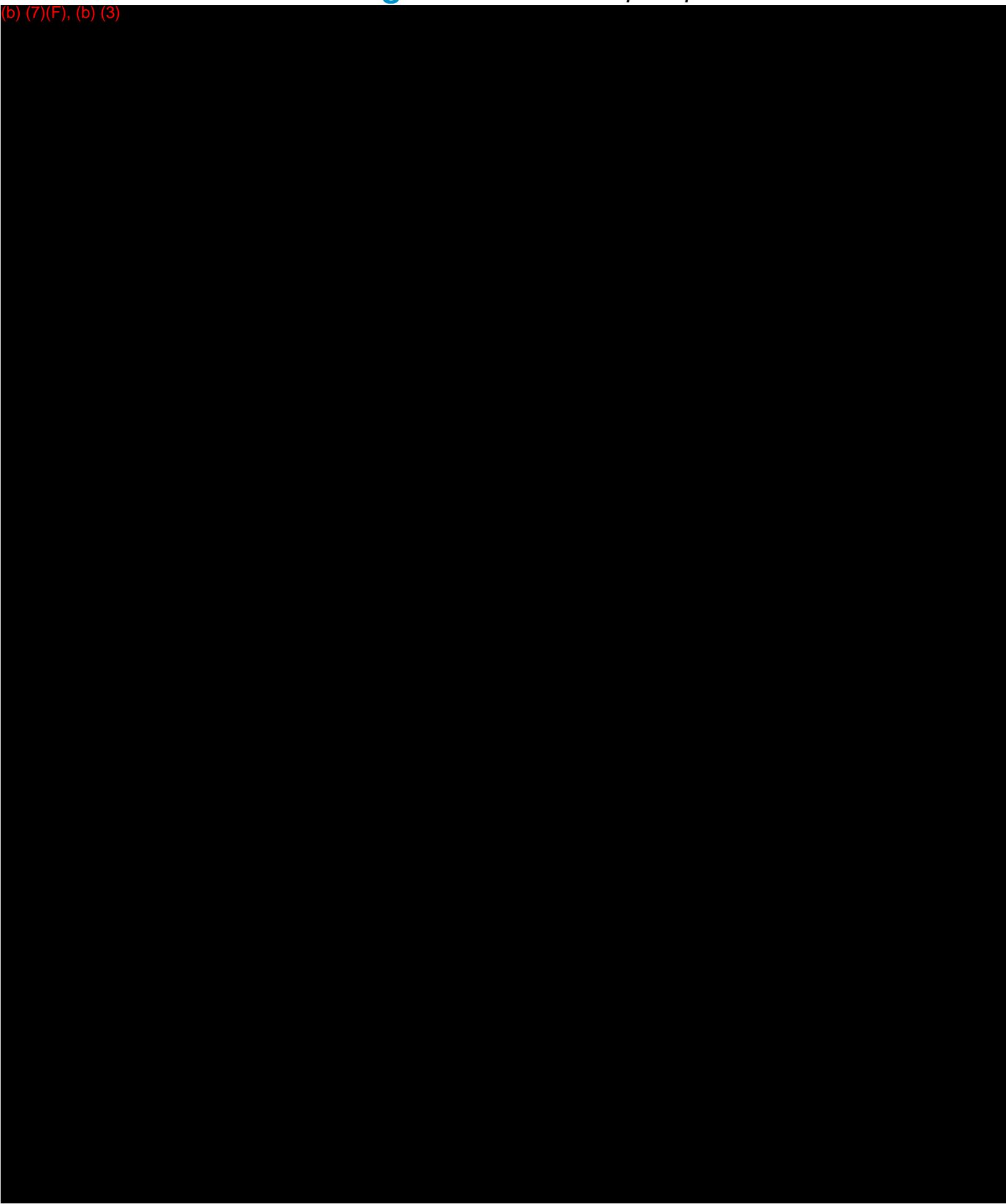
The local USCG Station's Vessel Traffic Service, (713) 674-8488, can provide current and tide information on a 24-hour basis. During daylight hours, surface velocity can be determined by timing drifting material for a measured length of dock or shoreline.

Spill Flow Direction:

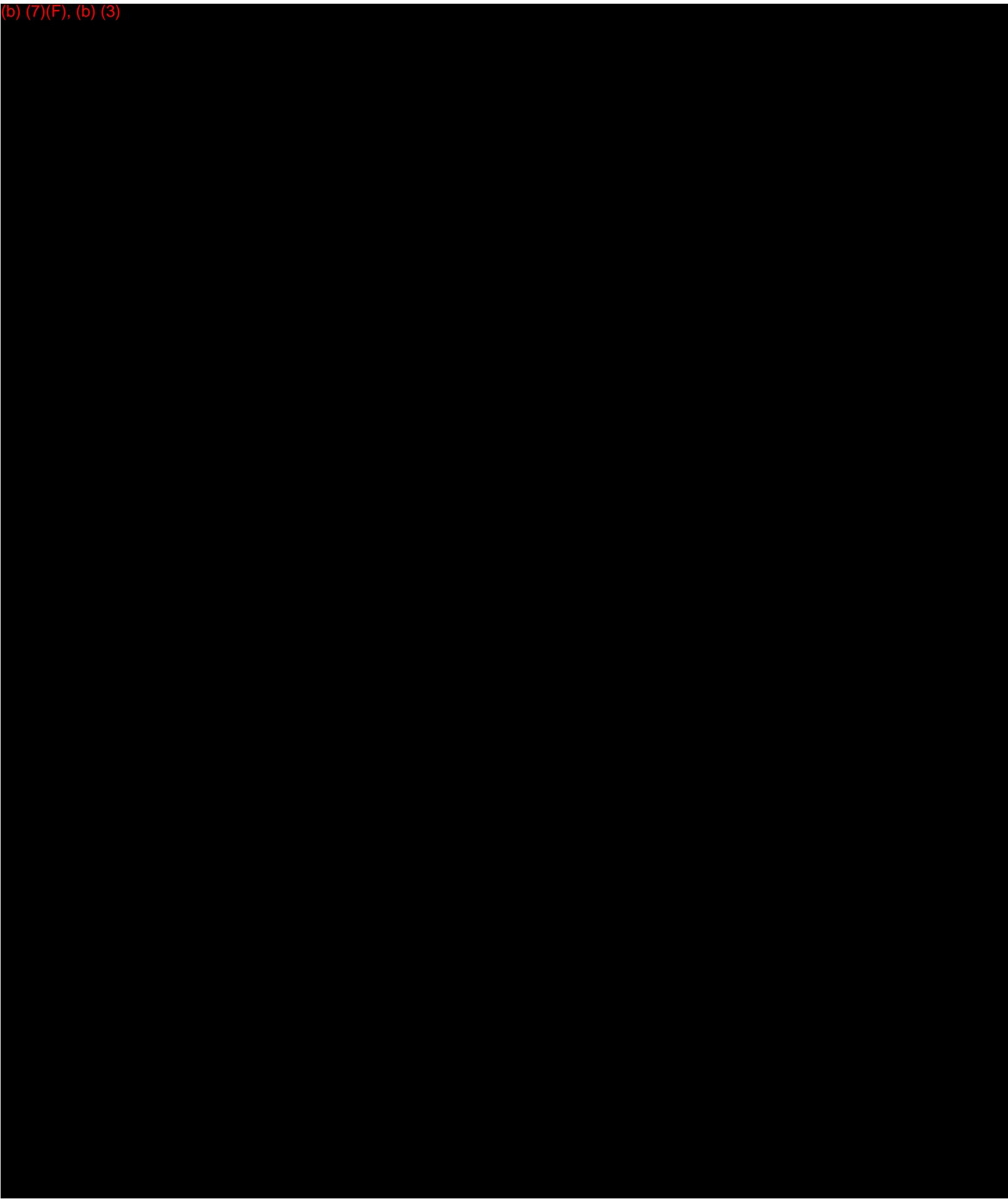
- ✓ No wind - oil will tend to move at the same velocity as the water surface.
- ✓ Wind and current in same direction - oil movement is the sum of the two velocities. (Note, an oil slick moves at about 3.4% of the wind velocity.)
- ✓ Wind and current in opposite directions - wind can reduce or reverse the water velocity at the surface. Oil could move upstream.
- ✓ High tide - acts to retard oil movement downstream.
- ✓ Low tide - acts in the downstream direction.

Note - tidal difference in the Houston Ship Channel is approximately 1 foot from high to low tide; therefore, it plays a minor role in determining spill direction. Actual on-scene observation of spill movement will take priority over the estimates done above.

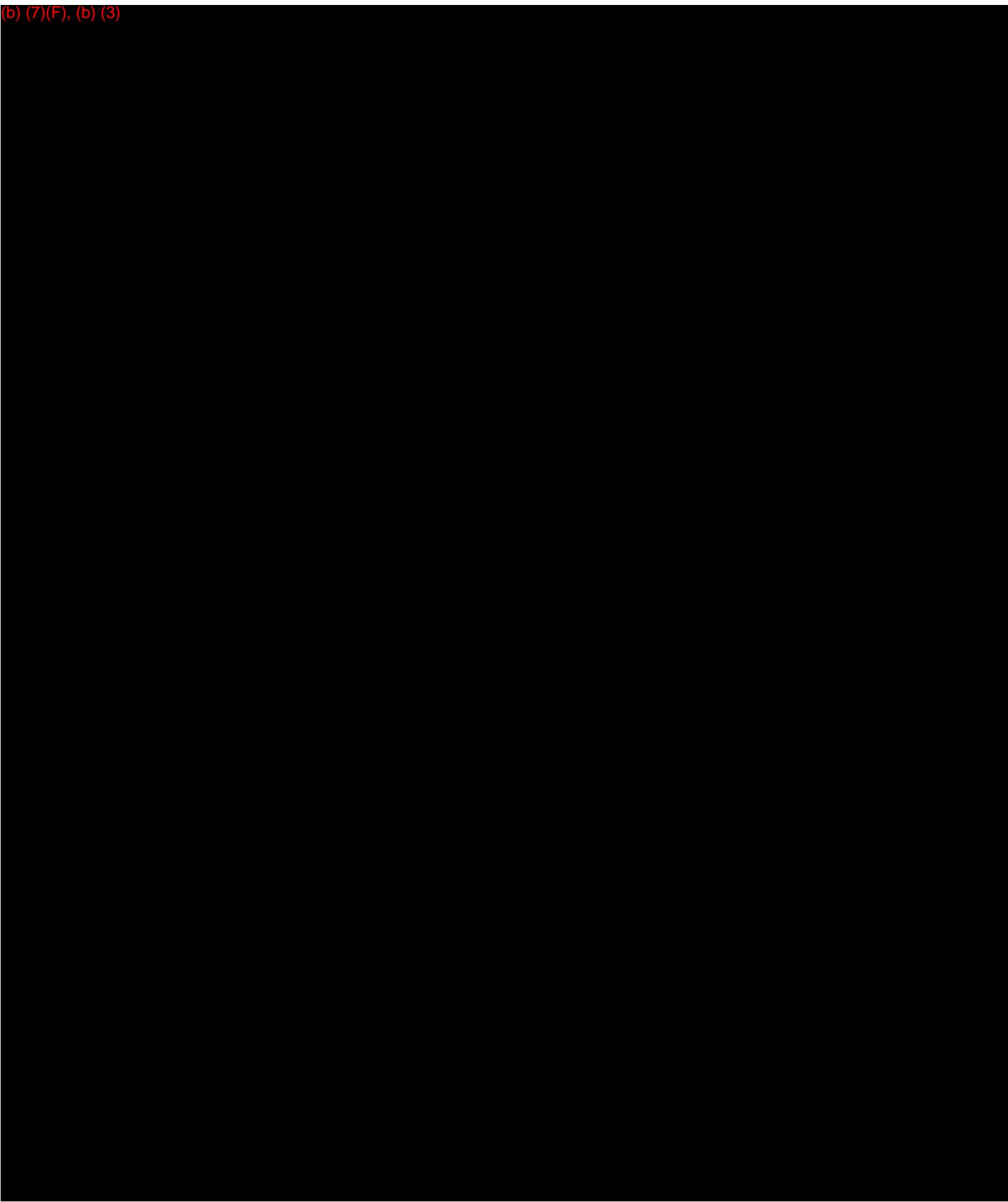
(b) (7)(F), (b) (3)



(b) (7)(F), (b) (3)



(b) (7)(F), (b) (3)



4.0 ANALYSIS OF POTENTIAL SPILLS

4.1 WORST CASE DISCHARGE

The worst-case scenario discharge for HRO is calculated using the criteria specified in the USCG, EPA, and DOT regulations §33 CFR 154, §40 CFR 112, and §49 CFR 194, respectively. The largest calculated spill will be used for planning purposes.

Since the scenarios vary by agency, each scenario is discussed separately and summarized below. HRO used the EPA calculated volume for persistent and non-persistent oils in Group 1 to Group 4 as listed below in [Table 4-1](#). The age of each tank along with its roof design and maximum fill capacity is provided in [Table 2-1](#).

Table 4-1 EPA Calculated Volume for Persistent and Non-Persistent Oils

Oil Group	Tank No.	Max Fill Capacity (bbls)*
1	134TK0850	(b) (7)(F), (b) (3)
	135TK0808	
	135TK0564	
	133TK0882	
	135TK0565	
	134TK0011	
	134TK0613	
	134TK0619	
Group 1 Total:		
2	133TK0876	
	135TK0578	
	133TK0879	
Group 2 Total:		
3	135TK0579	
	135TK0578	
	134TK0609	
	134TK0867	
Group 3 Total:		
4	136TK0558	
	138TK0006	
	136TK0559	
Group 4 Total:		

The EPA worst-case discharge for the Group 3 oil (heavy aromatics) is based on the largest Group 3 oil storage tank within secondary containment, and all the tanks use operational controls to meet secondary containment criteria specified in [Section 2.2.3](#). During the facility evaluation, HRO determined Tank 579 is the largest Group 3 tank, so it was selected for calculating the EPA worst-case discharge (catastrophic tank failure). The EPA scenario involves a catastrophic tank rupture onto concrete or earthen material resulting in the entire contents entering the Sims Bayou and eventually the Houston Ship Channel via a breach of the containment dike wall.

(b) (7)(F), (b) (3)

Prevention measure	Standard	Credit (%)
Secondary containment > 100%	NFPA 30	50
Built/repaired to API standards	API STD 620/650/653	10
Overfill protection standards	API RP 2350	5
Testing/cathodic protection	API STD 650/651/653	5
Tertiary containment/drainage/treatment	NFPA 30	5
Maximum allowable credit		75

DOT Breakout Tank Worst-Case Discharge = (b) (7)(F), (b) (3)

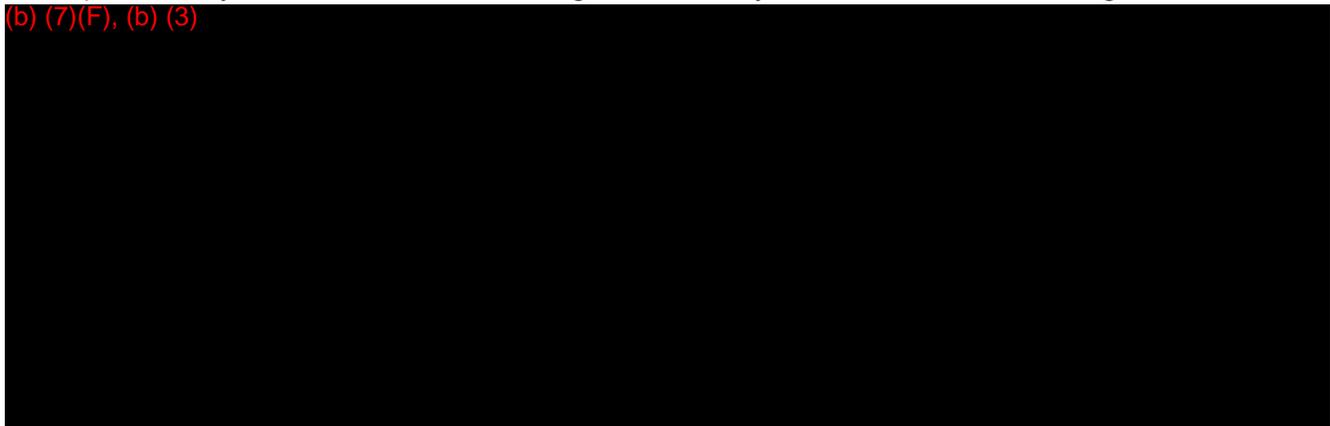
(b) (7)(F), (b) (3)



Since there is no historic discharge data for this scenario, the estimate is based on best engineering judgment. Under worst-case conditions of darkness and severe weather, it is estimated that the time to detect and shutdown the flow would be ≤ 1 -hour. The total spill volume is calculated to be (b) (7)(F), (b) (3)

The weather at the time of the worst-case discharge is assumed to be rainy, and the distance to the Sims Bayou as well as fish and wildlife and sensitive environments is less than one-half mile. Due to development on the adjacent property, surface topography will decrease the likelihood that a discharge will reach the Sims Bayou. Remediation equipment will be provided by the OSROs. The following is a summary of the worst-case discharge:

(b) (7)(F), (b) (3)



Therefore the worst-case spill for estimating response time is the loss of the contents from the four Group 3 tanks used for the EPA worst-case scenario is illustrated in [Figure 4-1](#).

4.2 MEDIUM DISCHARGE

The "maximum most probable discharge" (medium discharge) is defined by USCG regulations (§33 CFR 154) as a discharge of 1,200 barrels or 10 percent of the worst-case discharge, whichever is less. This is larger than the EPA planning volume or 36,000 gallons (857 barrels) (§40 CFR 112). The planning volume is 1,200 barrels. A medium discharge scenario is discussed in [Section 5.2.3](#).

4.3 SMALL DISCHARGE

The "average most probable discharge" (small discharge) is defined by USCG and EPA regulations (§33 CFR 154 and §40 CFR 112) as a discharge of 50 barrels. A small discharge scenario is discussed in [Section 5.2.4](#).

4.4 HISTORICAL OIL DISCHARGES

A list of historical tank failures from 1996 to 2013 resulting in the release of oil is presented in [Table 4-3](#).

4.5 DISCHARGE CHARACTERISTICS FROM EQUIPMENT FAILURE

This section describes the characteristics of discharges due to failure of the various types of major equipment used at the Facility.

4.5.1 Storage Tank Leak or Failure

- ✓ Direction of Flow: Outside containment or wastewater sewer system, drainage is towards the Houston Ship Channel.
- ✓ Rate of flow: Variable—depends on the size and location of the tank failure.
- ✓ Total quantity of oil: Should not exceed the working capacity of the tank, which is the maximum normal fill level of the tank (safe working capacity).

4.5.2 Tank Overfill

The maximum quantity of oil potentially discharged is based on a tank overfill resulting from failure of overfill protection equipment while a tank is being filled.

- ✓ Direction of Flow: For loss of secondary containment in the 225 Tank Farm, South Tank Farm, Allendale Tank Farm, and West Tank Farm, drainage would be toward the Houston Ship Channel via Sims Bayou located on the west side of the facility. For loss of secondary containment in the East Tank Farm and Heavy Oils Tank Farm, drainage would be toward the Houston Ship Channel via Vince Bayou and Light Company Road drainage located on the east side of the facility. For loss of secondary containment in the Central Tank Farm, drainage flows into the in-plant drainage system.
- ✓ Rate of Flow: Not greater than (b) (7)(F), (b) per hour based on the Enterprise pipeline delivery rate into tankage. Storage tanks are filled by the refinery operated equipment, which has a maximum pumping rate of 15,000 barrels per hour.
- ✓ Total Quantity of Oil: Variable – the amount of oil released is dependent upon the amount of time that elapses before the failure is detected, how long it takes block-in the line or connected secondary containment area, and how quickly a controlled shutdown can be completed to stop the release from the tank.

4.5.3 Tankcar/Tank Truck Overfill, Hose Failure in Loading Rack Area

- ✓ Direction of Flow: The tankcar/tank truck loading rack is equipped with an in ground hydrocarbon collection system, so oil resulting from overfills and hose failure will drain into the in-plant drainage system.
- ✓ Rate of Flow: Not greater than 275 gallons per minute based on the delivery rate for both railcars and tank trucks.
- ✓ Total Quantity of Oil: Variable – the quantity of oil spilled is dependent upon the amount of time that elapses before the failure is detected, how long it takes block-in the line, and how quickly a controlled shutdown can be completed to stop the loading/unloading operation.

4.5.4 Pipeline Manifold Areas, Equipment Failure

The maximum quantity of oil potentially discharged is based on a failure of the piping system due to corrosion. Another failure mode could be from contact by vehicles or other equipment.

- ✓ Direction of Flow: For piping system failures outside secondary containment areas in the 225 Tank Farm, South Tank Farm, Allendale Tank Farm, and West Tank Farm, drainage would be toward the Houston Ship Channel via Sims Bayou located on the west side of the facility. For piping system failures outside secondary containment areas in the East Tank Farm and Heavy Oils Tank Farm, drainage would be toward the Houston Ship Channel via Vince Bayou and Light Company Road drainage located on the east side of the facility. For piping system failures outside secondary containment areas in the Central Tank Farm, drainage flows into the in-plant drainage system.
- ✓ Rate of Flow: Not greater than (b) (7)(F), (b) (3) per hour, based on the Enterprise pipeline delivery rate to tankage.
- ✓ Total Quantity of Oil: The amount of oil released is dependent upon the time that elapses before the failure is detected, how long it takes block-in the line, and how quickly a controlled shutdown can be completed to stop flow through the pipeline to the Facility.

5.0 SPILL MITIGATION PROCEDURES

5.1 MITIGATION PROCEDURES FOR OPERATIONAL ACTIVITIES

5.1.1 Procedures for Equipment Leaks and Spills

Secondary Spill Containment

It is the policy of HRO to provide either permanent or temporary spill containment, where practical, to ensure no oil or other chemicals are unintentionally released to navigable waterways, to the soil, and/or to the plant sewer systems.

The guidance provided below pertains to storing liquid materials in drums, totes, and other containers; use of unmanned powered equipment (e.g., light carts, pumps, compressors, generators, welders, and power washers); and use of frac tanks and vacuum boxes.

- ✓ Inside Curbed Concrete Areas – storage of liquid materials and use of unmanned powered equipment inside curbed concrete areas is exempt from secondary spill containment as long as leaks/spills are mitigated and every effort is made to prevent hydrocarbons from entering the storm water collection sewer or contaminating soil, rock, or gravel. Use of kiddie pools is recommended when equipment is found leaking.
- ✓ Outside Curbed Concrete Areas – secondary spill containment shall be provided when storing liquid materials or using unmanned powered equipment located outside curbed concrete areas or in remote locations.
- ✓ Temporary secondary spill containment shall be provided during filling operations for all frac tanks and vacuum boxes containing hydrocarbons and/or waste liquids.

Spills on Land

EPA identifies the immediate actions as following:

- ✓ Stop the product flow. Act quickly to secure pumps, close valves, etc.
- ✓ Warn personnel. Enforce safety and security measures.
- ✓ Shut-off ignition sources (e.g., motors, electrical circuits, open flames, etc.).
- ✓ Initiate containment around the tank and/or in the water with oil boom.
- ✓ Notify National Response Center at: (800) 424–8802.
- ✓ Notify State or Federal On-Scene Coordinator.
- ✓ Notify other agencies, as appropriate.

As specified in the facility [EAP](#), all spills must be reported immediately in accordance with [HSE-EAP-002 Emergency Notification and Response](#) procedure. Depending on the type, amount, location, and duration of the spill, the EOC may be activated. The EOC is activated immediately if a fire or potential fire exists as a result of the spill, or if the source of the spill has to be stopped by HAZMAT members of the ERT. The ERT organization has adopted the Channel Industries Mutual Aid (CIMA) [Emergency Response Safety Plan Procedure](#) and uses both the [Level 1 Site Safety Plan Template](#) and the [Level 2 Site Safety Plan Template](#) to cover response location safety and health plan requirements specified in §154.1035(e)(5).

The area must be cleaned to pre-spill conditions. This determination can be made by sampling and testing the soil, or a visual determination by the On-Call Environmental Engineer and/or the Solid Waste Coordinator. The type of verification analysis will depend on the type of material spilled.

A sample of the spilled material may be needed for analysis for determining the proper method and location of disposal. The Solid Waste Coordinator will assist with the sample collection.

Spills at the Docks

As with spills to land, all dock spills and spills on the Houston Ship Channel are reported immediately in accordance with [HSE-EAP-002 Emergency Notification and Response](#). Specific emergency operating procedures have been developed to provide the immediate actions to be taken in the event of a spill or emergency shutdown of the Marine Terminal Dock Operations as specified in 139 Terminal Docks Emergency Operating Procedures.

Depending on the type, amount, location, and duration of the spill, the EOC may be activated. The EOC is activated immediately if a fire or potential fire exists as a result of the spill, or if the source of the spill has to be stopped by HAZMAT members of the ERT.

As discussed in Section 3, the Dock Spill Response Team will deploy the initial containment boom in order to confine a dock spill. The PSS (Field Coordinator) or the Oil Movement Shift Foreman (Dock Spill Team Leader) will activate the Dock Spill Response Team.

At the same time, an outside spill remediation contractor will be contacted to provide additional booms and deploy them as needed. They will also provide clean up assistance to remove spilled material from the water and shore. The contractor will be supervised by the Field Coordinator.

The Solid Waste Coordinator will provide assistance with proper disposal of residual clean up materials, (sorber pads, rags, PPE and other oily materials).

5.1.2 Procedures for Fires and Explosions

In the event of an explosion and/or fire, the procedures listed below from the [EAP](#) must be followed:

- ✓ Dial Extension 4444 or contact the SOC on radio (b) (7)(F), (b) (3) and report the emergency condition.
- ✓ Give exact location and nature of the emergency and provide as much information as possible. The more information provided the more effective the response will be.
- ✓ Give your name and job title.
- ✓ Tell what product is involved.
- ✓ Tell what, if any, injuries there are (number, type, severity, etc.).
- ✓ Make sure all information is understood. Stay on the line until dismissed by the dispatcher to ensure that all necessary information has been communicated.
- ✓ Pay attention to the Dispatcher for any emergency action instructions.

The EAP is the document that contains all the pertinent information for emergency response procedures.

5.1.3 Spill Mitigation and Shutdown Sequence

The following scenarios would be the most likely sources for discharges into the HSC.

Failure of Manifold: Immediately shut down pumping equipment and close all line and ship manifold discharge valves. Every attempt will be made to prevent the spill from entering the water by either pumping from the sump or deck drainage system into drums or other appropriate containment device, directing the flow into a containment or collection area away from the water, or placing containment boom or sorbent material in area. If the spill enters the water, immediately deploy facility owned equipment and contact the USCG approved OSRO as needed to assist with spill containment.

Failure of Transfer Equipment (Loading Arm or Hoses): Immediately shut down pumping equipment and close upstream and downstream block valves. Clean-up will be initiated immediately using the same mitigation measures as a manifold failure.

Piping Rupture: In areas without containment, contain spill with soil dikes or sand bags and or oil sorbent socks, and remove retained oil with vacuum truck for reuse. Some oil may reach the refinery sewer system, which will carry the oil to the wastewater collection. The API Separator will remove small quantities of oil entering the OWS system, and oil entering the Storm Water and QQQ collection systems should be recovered by oil skimmers on (b) (7)(F), (b) (3).

Piping Leak: Oil leaks outside the tank dike area will flow down the refinery sewer system to the wastewater treating system. The API Separator will remove oil entering the OWS system and the oil skimmers on Tanks 835 and 838 will remove any oil entering the storm water collection system, which will be subsequently reprocessed. Mitigation procedures for pressurized and non-pressurized piping leaks will be the same with the exception of shutting off pumps as would be the case for a pressurized piping leak.

Tank Overfill: Oil from a tank overfill will be contained within the dike area. Any spilled oil will be removed from the dike area with vacuum trucks, separated, and reprocessed.

Tank Failure: Same as Tank Overfill.

Explosion/Fire: After stopping the flow of the leak, any resulting oil spill will be removed from the affected area with vacuum trucks, separated, and reprocessed.

Equipment Failure: Same as Piping Leak.

Maintenance Operations: Any maintenance operation that could result in oil spillage must be given special consideration to prevent oil from reaching navigable waters. Before any maintenance operation is initiated, equipment is drained to the proper containment system.

5.2 OIL DISCHARGE MITIGATION PROCEDURES

5.2.1 Worst Case Discharge – Land and Water

In the event of a worst-case oil spill event, as described in Section 4, the following steps will be taken in addition to the procedures specified in the [EAP](#):

- ✓ Plant Shift Superintendent (PSS) is notified of a spill by Unit Operator or Shift Supervisor.
- ✓ PSS activates the Spill Response Team and notifies Garner Environmental.
- ✓ PSS goes to scene and accesses the situation.
- ✓ PSS activates the IC per EAP requirements.
- ✓ Garner Environmental will deploy additional booms across the Houston Ship Channel up and down stream of the spill once the USCG stops ship traffic on the Channel. Garner Environmental response equipment is listed in [Figure 3-8](#).
- ✓ IC ensures agency notifications are made, notifies the QI, and requests assistance as needed from CCA as needed.

- ✓ CCA responders will be asked to boom off environmentally sensitive areas as shown in [Figure 5-1](#). CCA is well equipped to respond to a worst-case spill as indicated by the equipment listed in [Figure 3-7](#).
- ✓ Emphasis will be to contain and recover the spill from the water as quickly as possible using shallow water and barge oil skimmers.
- ✓ Shore line clean-up will follow as soon as water clean-up is completed. **Dispersants will NOT be used** unless authorized by Federal or State authorities.

HRO has the manpower resources to maintain the IC on a 24-hour schedule for the duration of the worst-case spill.

5.2.2 Worst Case Discharge – Pipeline

Pipeline spills can be detected by various refinery personnel who are on-site 24-hours per day, 7-days per week. Oil Movement personnel frequently inspect active pipelines and are in contact with the control room via two-way radios. As discussed in Section 3, the first person to detect a spill or pipeline rupture will immediately notify his/her supervisor. The supervisor will notify the PSS, who will determine if the plant EAP needs to be activated. This will depend on the type of material spilled, amount and location.

Mitigation Procedures: In the case of a worst-case pipeline spill, our HAZMAT Team and the HRO spill response contractors identified in [Section 3.3.2](#) will respond within one-hour. HRO also has standard earth moving equipment that can be used to assist in spill control and containment. The worst-case pipeline spill would affect State Highway 225 and the EOC would be activated.

The following procedures will be followed in the event of an emergency response to a pipeline leak:

- ✓ Once a leak is detected, Oil Movements will shutdown the affected pipeline as soon as possible.
- ✓ The Oil Movements Manager, Pumper Foreman, and PSS will determine the appropriate course of action, which may include activating the EOC. Spill response contractors will be notified if additional assistance is required.
- ✓ Isolate the leak site from the source by closing the block valves on each side of the leak until conditions are brought under control.
- ✓ Eliminate all nearby ignition sources, especially those downwind from the source.
- ✓ Check the [MSDS](#) to determine the toxic and flammable characteristics of the material involved in the incident.

- ✓ Establish site control and secure the area depending on the alert level status. Adjust area if the weather conditions change.
- ✓ The affected area shall be cleaned up and repaired.
- ✓ A post incident review shall be conducted to prevent future incidents.

5.2.3 Maximum Most Probably Discharge

The planning volume for a maximum most probable discharge is 1,200 barrels. The procedures for responding will be the same as for the worst-case discharge to the Houston Ship Channel with the following exceptions:

- ✓ In most cases, Garner Environmental will be able to contain and collect the spilled material.
- ✓ If the discharge is greater than 250 barrels, CCA may partially mobilize equipment (barge skimmer) to provide sufficient clean up equipment to assist Garner Environmental and to protect environmentally sensitive areas.

Description of Discharge: This size discharge would most likely occur due to a major equipment failure or during product transfer. Examples may include, but not limited to:

- ✓ Line or flange rupture
- ✓ Valve rupture
- ✓ Misc. Tank failure
- ✓ Tank or truck overfill
- ✓ Pipeline manifold rupture

Because of diked and other containment located throughout the refinery and adjacent tank farms, it is very unlikely that the discharge would leave the facility property or reach a navigable waterway before spill containment could begin. However, HRO is located directly adjacent to the Houston Ship Channel. The distance to Sims Bayou or the Houston Ship Channel, fish and wildlife and sensitive environments is less than one-half mile from the perimeter of the Facility. If the discharge occurs in the vicinity of the dock, surface topography increases the likelihood that a discharge will reach the waterway. If required, remediation equipment will be provided by the OSROs.

The threat of damaging fish, wildlife, and sensitive areas is high due to heavy industrial activity along the Ship Channel. Therefore, impact to these areas should be avoided and/or minimized if at all possible.

In the event of a medium size discharge, Garner Environmental Services would be notified. While waiting for assistance from Garner, qualified facility personnel would attempt to contain the discharge with the facility-owned equipment listed in [Table 3-3](#). Diked area containment of large spills can be handled with the use of contractor vacuum trucks.

This type of spill would not impact shore side wells or drinking water intakes. Inclement weather conditions such as hurricanes, tropical storms, and heavy rains could affect response efforts if the spill entered Sims Bayou. Finally, this type of spill is not one that would result in a chain reaction of failures of other equipment.

Response Requirement: The facility shall identify sufficient response resources, by contract or other approved means, to respond to a Medium/Maximum Most Probable Discharge. The response resources shall, as appropriate, include:

- ✓ Oil recovery devices with an effective daily recovery capacity equal to 50% of the Medium/Maximum Most Probable Discharge volume must be capable of arriving on scene within 12-hours.
- ✓ Sufficient quantity of containment boom must arrive within 6-hours for oil collection and containment and for protection of fish and wildlife and sensitive environments, as appropriate.
- ✓ Temporary storage capacity equal to twice the daily recovery capacity must be available.

Facility Response Resources and Capability: The facility will initially respond to a Medium/Maximum Most Probable Discharge with a similar response to the Small Discharge. Additional response OSRO resources will be requested as needed which will arrive within 12-hours.

- ✓ Oil recovery devices with an effective daily recovery capacity of 50% of the Medium/Maximum Most Probable Discharge volume secured from the OSRO contractor(s) will be on scene within 12-hours.
- ✓ (b) (7)(F), (b) (3) capacity for recovered oily material will be secured from the OSRO contractor(s) and/or made available within HRO's storage facilities.
- ✓ Containment boom for oil collection and containment and for protection of fish and wildlife and sensitive areas will be secured from the OSRO contractor(s) in the event that the spill escapes the boundaries of the facility and impacts Sims Bayou, the Houston Ship Channel and/or the wastewater treatment system.

5.2.4 Average Most Probably Discharge

Based on the volume stated in Section 4, the average most probable discharge would be 50 barrels. This size discharge would most likely occur due to minor equipment failures or human error. Examples may include, but not limited to, pump seal leaks, dock hose ruptures, valve leaks, container ruptures, and pipe ruptures.

The types of material that could be discharged include any of the products that are handled at the facility. Examples include, but are not limited to, gasoline, fuel oil, crude oil, diesel fuel, naphtha, kerosene, methanol, toluene, xylenes, spent caustic, additives, and lube oil.

This size discharge would likely be noticed quickly and appropriate clean up measures taken since product transfers are monitored by facility persons in charge (PICs) and/or by vessel or barge tanker men. These types of small spills are typically contained on the dock platform, barge or vessel deck.

While the OSRO or spill contractor would be notified and the best method for containment determined, such discharges that are contained at the dock or barge or vessel deck could be diverted to product tanks. Response contract vacuum truck, absorbent pad and boom, or other equipment can handle such spills that go into the water. Response efforts for a spill of this size would more than likely not be affected by adverse weather conditions.

This type of spill would not impact shore side wells or drinking water intakes. Finally, this spill type is not one that would result in a chain reaction of failures of other equipment.

Response Requirement: The facility must identify sufficient resources, by contract or other approved means, to respond to a small discharge. The response resources must include at a minimum:

- ✓ 1,000-foot of containment boom or twice the length of the largest vessel that regularly conducts oil transfers to or from the facility, whichever is greater, and the means of deploying and anchoring the boom at the facility within 1-hour of the detection of a spill.
- ✓ Oil recovery devices with an effective daily recovery capacity equal to the amount of oil discharged in a Small/Average Most Probable Discharge or greater which is available at the facility within 2-hours of the detection of an oil discharge.
- ✓ Oil storage capacity for recovered oily material equivalent to twice the effective daily recovery rate.

Facility Response Resources and Capability: The facility will respond to a Small Discharge/Average Most Probable Discharge with manpower and equipment identified in

[Table 3-3](#) as well as OSRO contract and Texas GLO manpower and equipment identified in [Figure 3-7](#), [Figure 3-8](#), and [Figure 3-9](#), respectively..

- ✓ A 50 barrel discharge typically will not escape the containment of the facility.
- ✓ In the unlikely event that a spill did escape the containment of the facility, it would be expected to impact Sims Bayou, the Houston Ship Channel or the facility wastewater treatment system, response operations would be implemented immediately upon discovery.
- ✓ Oil containment and recovery devices can be secured from contract resources (with a minimum effective daily recovery capacity of 50 barrels) and can be implemented at the facility, as the situation demands.
- ✓ A minimum of 100 barrels of oil storage capacity for recovered oily material can be secured from contractor resources or made available within HRO's storage facilities as the situation demands.
- ✓ Additional recovery and storage equipment may be secured from Channel Industries Mutual Aid (CIMA), and other contract resources, as the situation demands.

In case of an average most probable discharge, HRO has appropriate containment or diversionary facilities to prevent land discharged oil from reaching the Houston Ship Channel. Dikes around storage tanks provide the first line of containment. Undiked areas are protected by an underground wastewater collection system. The sewer system carries oil to the wastewater treatment facility where oil is removed in the API Separator.

Spills that occur at the docks and go directly into the Houston Ship Channel have to be contained quickly to minimize any impact to Environmentally Sensitive Areas as illustrated in [Figure 5-1](#). Depending on the material spilled, weather, tides, and the time of day, dock spills can usually be contained at the docks because there is a ship or barge being loaded or unloaded, and boat operators will help deploy containment booms if it can be one in a SAFE manner. The distance to Sims Bayou or the Houston Ship Channel, fish and wildlife and sensitive environments is less than one-half mile from the perimeter of the Facility. If the discharge occurs in the vicinity of the dock, surface topography increases the likelihood that a discharge will reach the waterway. Remediation equipment, if required, will be provided by the OSROs.

When a leak is discovered, the responsible unit should attempt to stop the flow after reporting the spill. Unit personnel need to stop the flow at a control point that is SAFE to approach. For a spill, the ERT will perform the following response activities under the direction of the command structure:

- ✓ Mitigate a spill or release through the use of vapor suppression, sorbent application, vacuuming, tarping, and/or skimming
- ✓ Isolate a spill area through the use of diversions, ditches, pits, sumps, dikes, dams, berms, and/or containment booms.
- ✓ Stop a leak through the use of over packing, patching, plugging, packers, and/or equipment shutdown.

A contractor under the direction of the command structure specified by the [EAP](#) may perform some of these activities.

5.3 SPILL RECOVERY STRATEGIES

5.3.1 Mechanical Recovery

Offshore: Available on-site emergency response equipment is limited to initial containment equipment. Spill response contractors will supply petroleum product recovery equipment. Recovery equipment includes additional booms, skimmers, and vacuum trucks. The response time for the contractors is approximately 30-minutes to 6-hours.

Contaminated Surfaces: Plant property (docks, roads, boats, vessels, etc.) and visually affected equipment or facilities will be physically cleaned by wiping gross contamination with oil sorbent material, followed by hydro blasting. The water accumulated from hydro blasting will be collected and placed in the refinery's wastewater treatment system. Used oil sorbent material will be placed in containers for off-site disposal.

Contaminated Soil: Spills to soil will be cleaned up quickly, normally within 24-hours, to minimize penetration of spilled material into the soil profile. Vacuum trucks will be used to remove spilled liquid material. Appropriate equipment (shovels, front end loader or backhoe) will be used to remove the affected soil and place it in a container (drum, bin or roll off box).

The affected soil will be properly disposed or recycled in accordance with TCEQ regulations, depending on the representative sample analytical results. Soil removal is discontinued when visually uncontaminated soil is reached. In some cases, analytical results (e.g., oil and grease, BETX, etc.) are needed to determine when uncontaminated soil is reached. Clean fill is brought in to fill in these excavations as needed.

Shorelines: In general, shoreline clean-up will be conducted manually to prevent detrimental effects to the environment by heavy machinery. Access to the shoreline will be by water, unless convenient roadways are available. Specific guidelines for shoreline clean-

up are presented below and the response resource operating criteria of oil recovery devices is presented in [Figure 5-2](#).

Shore Clean-up Advisory Team: The shoreline along the Houston Ship Channel can be characterized as man-made shore with dredge spoil banks. The HSSE Environmental Department will escort all responding regulatory agencies and will serve as Liaison Officer.

Recommended actions and actions to avoid when dealing with substances with properties similar to oil are presented in [Table 5-1](#). In all cases, the use of boom and skimmers is the preferred method of protecting the shoreline. Except for manual removal on the Houston Ship Channel bank, no preferred option exists for removal and disposal. Mixing exposes contaminated sand to evaporation and is practical only for open sand beaches.

Natural cleaning (leaving the substance to degrade naturally) is preferred because it would have a lesser environmental impact. Low pressure flushing is preferred in the tidal flats; the work area should be boomed and the spilled substance collected or absorbed to prevent recontamination. [Table 5-2](#) discusses these oil spill response options in detail.

5.3.2 Recovered Oil Storage

HRO has storage available for recovered crude and product oil that exceeds twice the effective daily recovery capacity required or 80,000 barrels per day (Group 3 Oil). The volume of storage available is summarized below:

- ✓ CCA: (b) (7)(F), (b) (3) (refer to [Figure 3-7](#))
- ✓ HRO's Tank 810 & 811: (b) (7)(F), (b) (3)
- ✓ Barges: vary in size (used to temporarily store recovered material from the CCA skimmer barges prior to recovery through the API Separator or Process Solutions)

Decanted water from recovery operations will be discharged to the front of the API Separator at the Vacuum Truck Dump Station. The remaining oil will be recovered and reprocessed.

Transfer of oil from skimmers to tankage will be made via vacuum trucks or the ballast water line from the Dock Area. Skimmers will dock at one of the barge docks for transfer of oil to the vacuum trucks. If the skimmers are too far away, the recovered material will be transferred to barges so the skimmers do not have to move from their recovery location. The barges can be unloaded at a later date. Booms will be placed around the vacuum trucks and in the water around the skimmer to contain any losses that occur during transfer operations. Off-loading of skimmers will take approximately 1-hour per skimmer. Access to the barge docks is limited to essential personnel only.

5.3.3 Separation of Oil, Water, and Debris

Oil/Water Separation: Oil will be separated in the API Separator. Water is discharged to a publicly owned treatment works, and oil is recovered and reprocessed.

Oil/Water Emulsions: All emulsions will be treated in the slop oil system where the water is discharged to a publicly owned treatment works, and oil is recovered and reprocessed.

Recovered Materials: Recovered oil will be placed in the refinery's slop oil system. Oil in the slop oil system is reprocessed. This method limits the high costs of disposal and minimizes harm to the environment.

Debris Contamination: Debris contamination will be prevented by containing the oil as quickly as possible with booms and adsorbents. Immediate containment will not only limit the amount of contaminated debris generated and the associated disposal cost, but will also minimize damage to the environment.

Supplies of booms and adsorbents are maintained throughout the dock areas so the response may be initiated immediately in the event of an oil spill. In the event that the spill cannot be contained, booms will be placed between the advancing oil front and shorelines, or other environmentally sensitive areas.

5.3.4 Waste Minimization

The best method of waste minimization is to contain the spill as quickly and efficiently as possible. Additional waste minimization methods include:

- ✓ Clean and re-use booms as often as possible.
- ✓ Recycle recovered oil in the refinery oil recycling system.
- ✓ Placement of protective booms around facilities that will require decontamination, such as docks, vessels, and mooring structures.
- ✓ Biological treatment of affected soil in a land treatment unit rather than landfill disposal, if the affected soil meets land ban criteria in §40 CFR 268.

5.4 WASTE DISPOSAL

Recovered liquid materials are recovered and reprocessed in the Coker Unit. Disposal of recovered sorbents are the responsibility of the clean-up contractor. Oil-affected soils are analyzed and disposed of according to applicable regulations.

5.4.1 Waste Material Identification

Waste materials generated from an oil or chemical spill clean-up operation are:

- ✓ Slop oil and oil sludge consisting of oil and other organic material such as soil and vegetation,
- ✓ Contaminated sorbent material,
- ✓ Contaminated soil and water from oil or chemical spills is recovered by vacuum truck and transferred to one of the slop oil tanks at the refinery.

5.4.2 Disposal Procedure

Waste materials must be disposed of to comply with federal and state hazardous waste and solid waste management regulations to avoid harm to the environment or spread of further contamination as specified in [HSE-ENV-610](#). The Solid Waste Coordinator and Environmental Affairs work together to ensure these procedures are followed. For spills with waste materials on site (during working hours), the Solid Waste Coordinator will ensure:

- ✓ Employees to handle the waste,
- ✓ Safety precautions are taken,
- ✓ Materials are placed in the proper drum or container,
- ✓ Drums are properly sealed and labeled, and
- ✓ Drums and containers are transported to the drum storage area for temporary (<90 day) storage.

HRO only transports solid waste to those facilities that have been audited and are pre-approved by the HSSE Environmental Department. After working hours, the PSS will instruct the SOC to call the Solid Waste Coordinator.

For off-site spills with waste materials, the clean-up contractor is responsible for placing waste in the proper containers with the proper labels, seal the containers, and transport the waste to the Container Storage Area where the waste will be temporarily stored until off-site disposal.

5.4.3 Transportation of Waste

All hazardous waste generated as a result of spill response will be taken to either of the two Container Storage Areas (CSAs). HSSE Environmental Department is responsible for disposal of all hazardous and non-hazardous waste generated from refinery operations. The group is well versed and experienced with securing transportation of waste bound for off-site disposal. No wastes will be taken off-site without the authorization of HSSE Environmental Department. Approved waste transporters and external waste disposal facilities are listed in [Table 5-3](#).

5.5 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas along and in the Houston Ship Channel have been identified in the EPA Region VI Inland Area ACP and the Galveston Bay ACP. As the planning distance, HRO uses 15-mile downstream (Baytown Tunnel) and 4-miles upstream (Turning Basin). [Figure 5-1](#) illustrates the location of environmentally sensitive areas with this reach of the Houston Ship Channel. [Table 5-4](#) describes where these areas are located and the amount of boom required.

The most effective way to protect these sensitive areas is to deploy containment boom across the entrances to bayous, inlets, and bays. This would be done prior to an oil spill reaching those reaches the adjacent waterways.

In the event of a worst-case spill, CCA will be able to provide rapid response for deploying boom in these sensitive areas. The criteria used for boom deployment in sensitive areas are listed in [Table 5-4](#):

A Priority: Marshes, Tidal Flats, and Bay Margins up channel to the Turning Basin and down channel to the Lynchburg Ferry Crossing, including the Battleship Texas and surrounding San Jacinto National Monument land and water structures.

- ✓ Boom length = $(15,525 + 15,525 + 4,500) = 35,550$ feet
- ✓ Time to deploy 6 hours
- ✓ Equipment and personnel 100 people, 40 johnboats and supply trailers.

B Priority: Marshes, Tidal Flats, and Bay Margins from the Lynchburg Ferry Crossing to the Fred Hartman Bridge, dredge spoil banks (Alexander and Goat Islands) and the rest of San Jacinto National Monument.

- ✓ Boom length = $(48,150 + 27,000 + 15,525) = 90,675$ feet
- ✓ Time to deploy 12 hours (18 hours into spill)
- ✓ Equipment and personnel 200 people, 80 boats and supply trailers

C Priority: Riverbanks and man-made shore

- ✓ Boom length = $(3,150 + 127,000) = 130,150$ feet
- ✓ Time to deploy 36 hours (54 hours into spill)
- ✓ Equipment and personnel 200 people, 80 boats and supply trailers

The above allocation of resources is done to maximize the deployment of booms ahead of the spill to protect the most sensitive areas in front of the spill. These estimates are based

on the CCA Resource Manual provided in [Figure 3-5](#) and personal communication with Garner Environmental Services. [Figure 5-1](#) indicates the environmental sensitive areas in close proximity to the refinery. These estimates may differ during an actual spill event depending on the rate of spill movement, wind, and tidal conditions.

Most of the CCA members are located on the Houston Ship Channel. In addition, HRO's response will be to deploy three booms up and downstream of the spill as close as possible to where the oil enters the Houston Ship Channel. The booms will be deployed across the entire width of the Houston Ship Channel. Recovery of spilled material will follow as soon as booms are in place to trap the material.

5.6 WILDLIFE PROTECTION AND REHABILITATION

There are seven species on the Federal Endangered Species list that may be found in the Harris County area, predominately bird species that pass through during migration. These species are listed in [Table 5-5](#) and consist of one reptile, one wild flower, and five birds. Protection of these species during an oil discharge will be a high priority, especially if these species are found in the area of a discharge. They will be given high priority for protection and rehabilitation, if the need arises.

Oil discharges, particularly in estuaries and near shore areas, often cause severe stress to resident and migratory birds. Oil contaminated birds are unable to fly, lose their natural waterproofing that allows them to float, and lose the insulating property of their feathers. The birds may often become ill from ingesting oil-contaminated water.

Cleaning oil contaminated birds requires specialized training and experience. HRO will not attempt to clean contaminated birds without proper direction from the appropriate authorities.

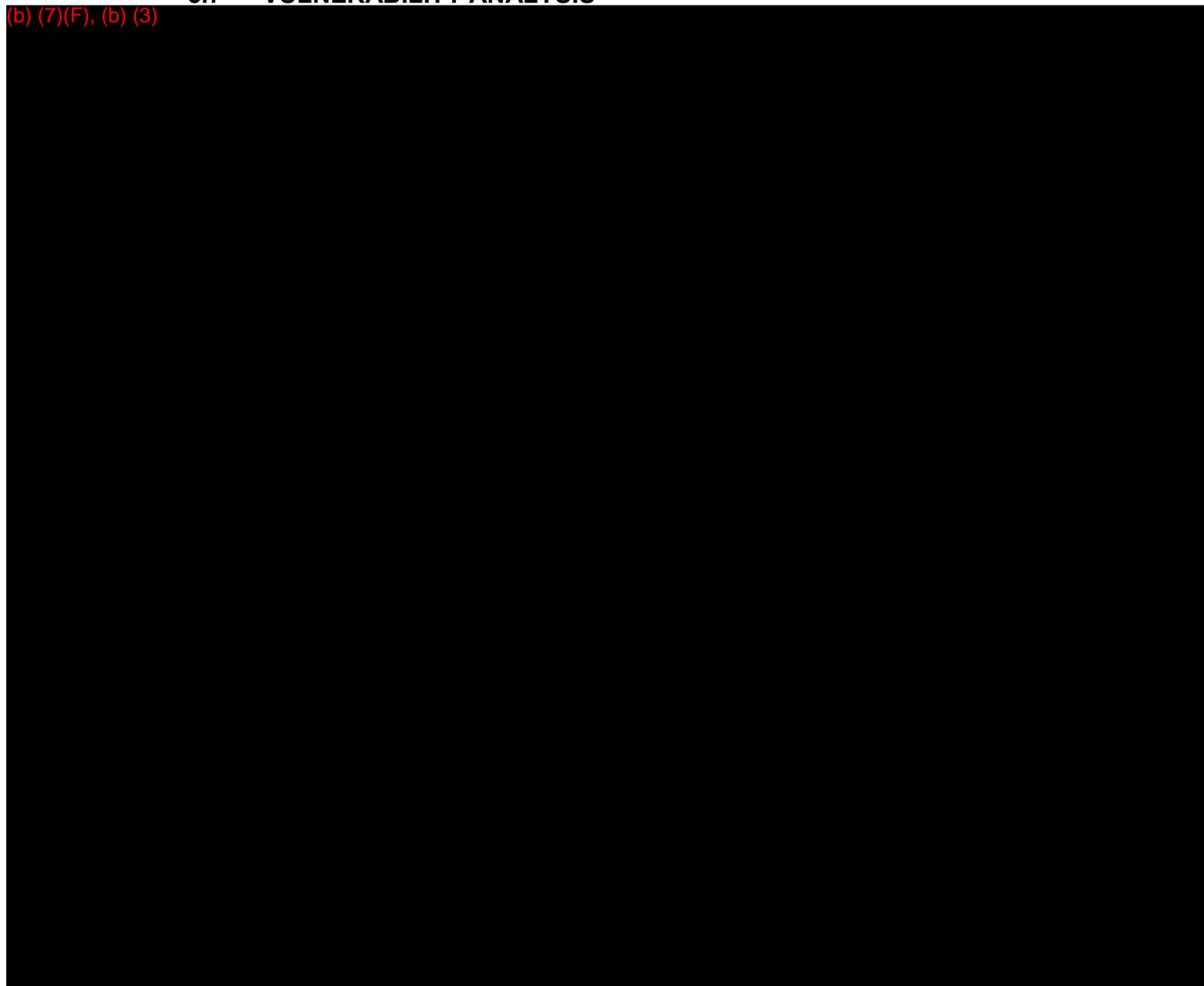
HRO will contact the following agencies and/or personnel for assistance in arranging and coordinating the collection, cleaning, and recovery of any oil-contaminated birds or other wildlife:

- ✓ Texas General Land Office: 800-832-8224 (24-hour Oil Spill Notification)
- ✓ Texas Parks & Wildlife: 281-842-8100 (24-hour Hotline); 281-534-0138; 281 534-0130 (office)
- ✓ U.S. Fish & Wildlife: Ron Brinkley at 281 286 8282 (office); 281-505-4754 (pager); or (b) (6) (cell).

- ✓ Wildlife Center of Texas: Sharon Schmalz or Margaret Pickell, Certified Oiled Wildlife and Response Team Members, at (b) (6) (cell); (b) (6) (cell); 713 279-1417 (pager); 281-418-8100 (pager); (b) (6) (home).
- ✓ Wildlife Response Services, LLC: Rhonda Murgatroyd, Certified Oiled Wildlife and Response Team Member, at 713-705-5897 (office); 281-266-0054 (pager).

5.7 VULNERABILITY ANALYSIS

(b) (7)(F), (b) (3)



Residential Areas

Residential populations begin within one mile of the Facility and continue outward. The coverage area of these areas is not continuous; rather it is broken up by commercial areas. Any evacuation efforts for these areas will be coordinated with the local emergency assistance agencies (police department, fire department, etc.).

Businesses

The immediate area surrounding the Facility is for the most part commercialized. The listing of businesses in the area of the Facility is extensive and is detailed in the applicable ACP. Any evacuation efforts for these areas will be coordinated with the local emergency assistance agencies (police department, fire department, etc.).

Fish and Wildlife, Wetlands, and other Sensitive Environments

The immediate area surrounding the Facility is commercialized and supports only minor amounts of wildlife. The overall impact on fish and wildlife, wetlands, and other sensitive environments will happen upon impact of the local waterways and associated non-commercialized areas.

The local ecosystem is host to a variety of species including migratory as well as year round inhabitants. The general species found in the area of the Facility are detailed in the applicable ACP. State and Federal agencies as well as contract resources will provide guidance on response and protection strategies during an actual response situation.

Flora and fauna are always present and are sensitive to the effects of a pollution incident. All environmental areas deserve protection from pollution, but they must be prioritized during a response so as to protect the most sensitive and susceptible areas to pollution.

Wetland habitats (as applicable) within the potential impact area of a spill originating from the Facility are identified on the Texas GLO and NOAA, Texas Oil Spill Planning and Response Atlas.

Lakes and Streams

The lakes, streams, and rivers that may be potentially impacted by a discharge originating at the Facility are identified on the Texas GLO and NOAA, Texas Oil Spill Planning and Response Atlas.

Endangered Flora and Fauna

The endangered flora and fauna that may be potentially impacted by a discharge originating at the Facility are detailed in Texas GLO and NOAA Texas Oil Spill Planning and Response Atlas.

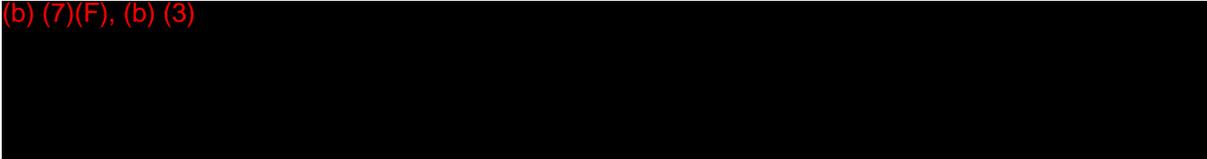
Transportation Routes (air, land, and water)

Land and water transportation routes could both potentially be affected by a discharge originating from the Facility. These transportation routes are identified on the Texas GLO and NOAA Texas Oil Spill Planning and Response Atlas.

The local emergency assistance agencies (police department, fire department, etc.) and the U.S. Coast Guard (as applicable) would be contacted for traffic control in the area of the discharge.

Utilities

(b) (7)(F), (b) (3)

**Other Areas of Economic Importance**

The local waterways are bordered by various dock facilities, other commercial facilities, and recreational/public use areas. Any evacuation efforts necessary for these areas will be coordinated with the local emergency assistance agencies (police department, fire department, etc.), State Police, U.S. Coast Guard, and other agencies as the situation demands.

6.0 HAZARDOUS MATERIAL IDENTIFICATION

Varieties of hazardous materials are present at the HRO. Most of the tanks at the refinery contain petroleum or petroleum products; a few contain clarified water, wastewater water, and pure chemical products. As specified in [Section 2.1.3](#), a complete set of [MSDSs](#) for all product streams, intermediates, and purchased chemicals used at the refinery is maintained electronically and available online through the HSSE webpage.

Production units no longer maintain hardcopy Hazard Communication Manuals at the unit since all PI&Ds, Process Flow Diagrams, and MSDSs for each refinery stream are maintained electronically and available online. A listing of the specific refinery streams (MSDS numbers) used in each production area can be found in LiveLink.

The site-specific list of CERCLA hazardous and SARA extremely hazardous substances (taken from §40 CFR 302 and §40 CFR 355) are listed in [Table 6-1](#). The table contains the reportable quantity amounts. In addition, HRO has provided a site-specific list of RCRA hazardous waste and respective spill reportable quantities in this section. These materials can be expected to be present at the refinery in threshold amounts. A list of hazardous and extremely hazardous substances can be found in §40 CFR 302 and §40 CFR 355 (as published in the Federal Register), and the hazardous waste classification is provided in [Table 6-2](#).

7.0 EQUIPMENT INSPECTION AND TESTING

7.1 Process Equipment and Piping

HRO is a fully integrated petroleum refinery. The facility is staffed by Operations and Maintenance personnel 24 hours per day, 365 days per year. Valves, flanges, aboveground pipelines, and other exposed equipment are routinely inspected during daily rounds. Plant operators conduct visual surveillance of the tanks and secondary containment basins during their normal course of their daily duties.

Underground pipelines are inspected anytime there is an excavation in the vicinity of the pipelines. Any leaks or spills are reported immediately. Aboveground storage tanks within secondary containment are subjected to integrity testing during routine scheduled inspections (per API 653 Standard for External Tank Inspections), when material repairs or alterations are performed, when there is a change in tank design, or when there is a change in tank service, as appropriate at the time of integrity test. The following are the techniques or combination of such techniques that may be used:

- ✓ Hydrostatic testing,
- ✓ Radiographic testing,
- ✓ Visual inspections
- ✓ Ultrasonic testing, (internal and external)
- ✓ Acoustic emissions testing, or
- ✓ Other system of nondestructive shell testing

These tests are used to check for the potential for brittle fracture failure to occur. Appropriate action will be taken to repair the tank, or to take the tank out of service. Records of periodic tank maintenance and inspections are filed and maintained with the Inspection department for a period of not less than 5 years. The Tank Inspection Checklist is provided below in [Figure 7-1](#).

Operating personnel make daily visual inspections of their facilities, record observations in the electronic Shift Notes, and write work orders as needed equipment repairs. The Maintenance department schedules work based on the priority assigned to the work order notification.

Figure 7-1 Tank Inspection Checklist

At a minimum, tanks are inspected against the following checklist:

Check tanks for leaks, specifically looking for:

- ✓ Drip marks
- ✓ Discoloration of tanks
- ✓ Puddles containing spilled or leaked material
- ✓ Corrosion Cracks
- ✓ Localized dead vegetation

Check foundation for:

- ✓ Cracks
- ✓ Discoloration
- ✓ Puddles containing spilled or leaked material
- ✓ Settling
- ✓ Gaps between tank and foundations
- ✓ Damage caused by vegetation roots

Check piping for:

- ✓ Droplets of stored material
- ✓ Discoloration
- ✓ Corrosion
- ✓ Bowing of pipe between supports
- ✓ Evidence of stored material seepage from valves or seals
- ✓ Localized dead vegetation

Maintenance maintains detailed records of the repairs and inspection conducted on each piece of equipment. These records include the manufacturer's specifications plus a listing of repair dates and type of repairs made. The inspector makes scheduled inspections of all stationary equipment in the refinery. Metal thickness is measured, corrosion rates are calculated, and predictions are made regarding the time remaining before retirement thickness is reached. The inspector maintains permanent detailed records of their observations and findings. All leaks are noted as are the depths of pits and general comments regarding corrosion observations. Periodic inspection is conducted of dock sumps and drip pans for signs of corrosion.

Oil transfer hoses are inspected at the docks for damage prior to pressure testing to ensure that the pressure testing area does not drain to the Houston Ship Channel. Marine Dock loading arms are hydrostatically tested annually back to the first block valve. (b) (7)(F), (b) (3)

and material drained to this sump is pumped to the API Separator for recovery and reprocessing.

7.2 Marine Spill Response Equipment

The HRO Spill Response Team conducts monthly inspections of major spill response equipment including oil spill response boats and containment booms. During each inspection, boat motors are operated and any problems are immediately reported to the Maintenance so repairs can be made. Containment booms are visually inspected to ensure they are ready for deployment and have no signs of significant deterioration.

The Senior Spill Response Team Captain is responsible for ensuring that the oil spill response equipment is well maintained, documenting the monthly inspections, and transmitting the inspection forms to the HSE Library where the records are maintained for at least 3 years. A copy of the monthly marine spill response inspection form is presented in [Figure 7-2](#).

7.3 Onshore Spill Response Equipment

Equipment designated for use during a spill response on includes a backhoe and/or a front-end loader, vacuum trucks, and sorbent material. This equipment is readily available, and preventative maintenance is routinely performed by the equipment user (either HRO or OSRO contractor). Since the equipment is used for many routine refinery operational activities, no formal maintenance record file is kept at the HSE Library.

Figure 7-2 Marine Response Inspection Form

RESPONDERS

Name	SS#	Emergency Contact Phone #

PRE-OPERATION SAFETY CHECK

- Boat registration and license are on board and current (required by Coast Guard)
- Use buddy system--nobody goes alone!
- Life jackets for all on board
- Plugs in bottom of boat are screwed in tight
- Gas tank & spare are full
- Oil reservoir full
- Battery is charged - unplug from battery charger
- Paddle & anchor
- Lights work (night time)
- Kill switch attached to driver's life jacket

Description of Vessel

Type: <u>flat-bottomed work boat</u>	Engines: Number <u>2</u>	Color: <u>Red</u>
Registration No.:	Horsepower: <u>50 HP & 6 HP</u>	Color of Trim: <u>Blue & Gold</u>
Make: <u>Boat Right (Custom)</u>	Fuel Capacity: <u>2 @ 6 Gal, 1 @ 2 Gal</u>	Sails: <u>N/A</u>
Length: <u>16 feet</u>	Type: <u>Outboard</u>	Canvas Top?: <u>N/A</u>

Survival Equipment: (Mark as appropriate)

PFDs _____	Flares _____	Mirror _____	Signal Flag _____	Signaling Flashlight _____
Anchor _____	Amount of Line _____	Radio Y / N _____	Type _____	

Trip Details

Depart: Date: _____ Time: _____	Return: Date: _____ Time: _____
Purpose: _____	

Figure 7-2 Marine Response Inspection Form, continued
Next Run Preparation

This list shows that all basic items needed for the next run are present or accounted for (that is, the order has been made to have any needed items fixed or replaced) after the run, and any comments on equipment's performance and suggestions for improved operations.

- Boat registration and license are on board and current (required by Coast Guard)
- Number of Life Jackets (Total)_____ 1) Put away_____ 2) To be cleaned_____ 3) To be replaced_____
- Plugs in bottom of boat are present; any water in boat has been allowed to drain.
- Gas line to 50 HP motor has been bled down.
- Gas tank #1 full_____ Gas tank #2 full_____ Spare tank full with **1/2 Qt. oil : 3 Gallons gas mix**_____
- Oil reservoir full.
- Batteries are plugged into battery charger.
- Paddle & anchor
- Line for anchor (ft.)_____, line for mooring_____, line extra _____
- Lights work: Q-Beam _____ Tail light works _____ Tail light stowed in compartment_____
- Spill boom disposition _____
- Ft. in Spill Barn _____ Ft. in boom box _____

COMMENTS: Fix or replace items? Does anything need to be ordered? Performance of equipment? Suggested changes to equipment or procedures?

Sign and return to the Battalion Chief after each run. Battalion chief forward a copy to HSE Library.

8.0 PERSONNEL TRAINING AND DRILLS

8.1 TRAINING PROCEDURES

8.1.1 SRPP Training

All HRO Operations and Maintenance personnel are required to review and become familiar with pertinent sections of the SRPP as necessary to perform their job requirements. At a minimum, this review shall include emergency notification procedures, spill reporting, and spill prevention guidelines specified in the [EAP](#). Training on the contents of this Plan is required for all new employees and on an annual basis for current employees as a part of HRO's Annual Regulatory Training (ART) program. Emphasis is placed on the above-mentioned procedures and on insuring a quick response to spills.

The Facility conducts prevention briefings for oil-handling personnel annually during ART to assure adequate understanding of the SPCC elements of the SRPP. These briefings include discussion of potential discharges or component failures and precautionary measures. Briefing records are maintained in the Plateau Training System as long as personnel are assigned duties under the SRPP.

8.1.2 HAZWOPER Training

All ERT personnel are given Hazardous Waste Operations and Emergency Response (HAZWOPER) Tech Level training as defined in §29 CFR 1910.120. This training program provides a general knowledge of hazardous materials, the processes an employee may encounter, and provides detailed information on how to deal with emergency conditions. The HAZWOPER Tech Level training incorporates 48 hours of training and qualifies the individual as a Fire Fighter/HAZMAT Technician. In addition, all HRO field personnel receive an annual refresher course to maintain the HAZWOPER First Responder Awareness training. Operations field personnel, to include Dock Operations receive HAZWOPER First Responder Operations Level Training. This training is sufficient to enable them to recognize hazardous situations and make an appropriate initial response to protect others in vicinity, company property, and the environment. All HRO personnel are also trained on Occupational Safety and Health (OSHA) Hazardous Communication and Emergency Planning and Community Right-to-Know (EPCRA) topics.

The ERT members are trained to respond to spills at the refinery according to the Emergency Response Team training manual, and team members are qualified as Fire Fighter/HAZMAT Technician. The course topics covered in the ERT quarterly training program includes the following:

- ✓ Introduction to Emergency Response
- ✓ Fire Science
- ✓ Portable Fire Extinguishers
- ✓ Water Supply Systems and Appliances – General
- ✓ Portable Monitors
- ✓ Structural Firefighting Turnout Gear
- ✓ Hose handling and Fire Streams Practice
- ✓ Pump Operation – General
- ✓ Foam Engine #1 – Operation/Specification
- ✓ Foam Aerial/Telesquirt #2 Operation/Specification
- ✓ Foam Engine #3 – Operation/Specification
- ✓ Engine #5 – Operation/Specification
- ✓ Supply Line and Attack Line Setup
- ✓ Relay pumping
- ✓ Respiratory Protective Equipment – Self-Contained Breathing Apparatus
- ✓ Air Supplied Respirators
- ✓ Search and Rescue
- ✓ Rescue and Confined Spaces
- ✓ High Temperature Protective Clothing
- ✓ Chemical Protective Clothing
- ✓ Hazardous Materials Response Planning to minimize the potential for fire, explosion of environmental damage
- ✓ Recognizing and Identifying Hazardous Materials which includes the characteristics and hazards of oil
- ✓ Risk/Hazard Assessment
- ✓ Site and Scene Management which includes conditions that are likely to worsen emergencies
- ✓ EAP Procedures
- ✓ Toxicology
- ✓ Decontamination
- ✓ Monitoring and Survey Equipment
- ✓ Basic Methods for Control and Containment
- ✓ Plugging and Patching Devices and Spill Containment for Pipeline Leaks
- ✓ Fire Fighting Foam

- ✓ Flammable Liquid Spill – Fire Fighting and Vapor Suppression Control
- ✓ Tank Fire Fighting
- ✓ Refinery Fire Fighting Protection Systems
- ✓ Gases
- ✓ Hazards of Gases
- ✓ Gas Emergency Controls
- ✓ Safety
- ✓ Fire Fighting and Electricity

ERT annual training requirements call for a minimum of 32 hours of mandatory training as specified in [HSE-EAP-011 Training and Exercise Plan](#). In addition, outside training may be offered at accredited schools. All specified ERT Officers and PSS are trained to HAZWOPER Level V On-Scene Incident Command (IC). In addition, outside advanced emergency management training at such institutions as Texas A&M University and Lamar University may be offered to Spill Response Team Members, Operations Chiefs, ICs, and Field Coordinators.

Personnel who support ERT team efforts in responding to spills may also receive HAZWOPER training. The level of HAZWOPER training an individual receives depends upon their respective job responsibilities during a spill. The required levels for spill response personnel are presented in the EAP. In addition, all contract personnel that assist HRO in spill response activities will be trained to at least the HAZWOPER Level III (HAZMAT technician). Volunteers or casual laborers will not be employed by HRO during spill response. Therefore, no training program has been established for these types of laborers.

HAZWOPER training records for all personnel referenced in the SRPP is collected by the Fire Chief and maintained in the HSE Library. The training records for HRO personnel and trainers consist of the following information:

- ✓ Employee name and position title or location
- ✓ Identification number
- ✓ Training topic
- ✓ Training date
- ✓ Trainer
- ✓ Training hours

These records are maintained in the HSE Library file as long as personnel are assigned duties under the SRPP. The contractors maintain training records for contractors' personnel.

8.1.3 Levels of Qualification

ERT training at HRO recognizes five levels of qualification and skill that progressively qualifies an individual for increasing responsibility in the Emergency Response Organization. HRO trains personnel to First Responder Awareness, Fire Fighter/HAZMAT Technician, and Incident Command Levels. . These three levels of qualifications are described as follows:

First Responder Awareness Level (All Personnel)

All individuals in the plant are trained to First Responder Awareness. These individuals are defined as those who are likely to discover or witness an emergency condition or release of a hazardous substance. These individuals are trained to:

- ✓ Initiate an emergency response sequence using proper notification protocols.
- ✓ Take no action, but to follow appropriate instructions.

First Responder Awareness Level (Operations)

Operations First Responders who discover or witness an emergency condition or release of a hazardous substance are responsible for additional first responder duties. All operations personnel are trained to:

- ✓ Initiate an emergency response sequence using proper notification protocols.
- ✓ Evaluate the hazard/risk and ensure proper PPE and equipment is used.
- ✓ Manage and control access to the scene and attempt to identify the problem
- ✓ Initiate ICS until relieved by responder with higher level of training.
- ✓ Attempt to identify the hazardous substance and estimate the quantity released,
- ✓ Monitor the area for airborne hazards and barricade entrance to the scene

Fire Fighter/HAZMAT Technician Level

Individuals who respond to releases and potential releases for the purpose of stopping the release are trained to this level. These individuals are trained to:

- ✓ Assume an aggressive or offensive role.
- ✓ Patch, plug, or stop a leaking hazardous material.

All ERT personnel are trained to the Fire Fighter/HAZMAT Technician level. This level of training includes:

- ✓ Knowledge of how to implement the Emergency Response Plan.
- ✓ Knowledge of the classification, identification, and verification of known and unknown materials by using monitoring survey equipment.
- ✓ Qualification to function within an assigned role in the Incident Command System (ICS).
- ✓ Knowledge of how to select and use proper specialized personnel protective equipment.
- ✓ Understanding of hazard and risk assessment techniques.
- ✓ The ability to perform advanced control, containment, and/or confinement operations within the capabilities of the resources and personnel protective available.
- ✓ Understanding of how to implement the contamination procedures and how to terminate containment procedures.
- ✓ Understand basic chemical and toxicology terminology behavior.

On-Scene Incident Commander Level

Personnel trained to Incident Commander Level are qualified to assume control of the incident scene and implement the ICS. Under the Emergency Response Plan, the first qualified Incident Commander trained person on the emergency scene implements the ICS and assumes the role of IC. That person continues to exercise the IC responsibility until relieved by a more senior individual. Personnel trained to this level include:

- ✓ EOC Staff
- ✓ All PSSs
- ✓ All HSE Representatives
- ✓ Designed Operations Shift Supervisors.

8.1.4 Marine Spill Team Training

The Spill Response Team is a division of the ERT. In addition to the HAZWOPER training referenced above, the Spill Response Team also receives separate marine spill training that is conducted according to Marine Spill Operations in conjunction with the spill drill exercises addressed in [Section 8.2](#). The Spill Response Team training and drills are conducted semi-annually. The spill training addresses the following topics:

- ✓ Oil spills in the environment
- ✓ Movement of oil on water

- ✓ Containment of oil on surface water
- ✓ Recovery of oil on surface water
- ✓ Response team equipment
- ✓ Oil spill clean-up contractors and cooperatives

The training records for the Spill Response Team are collected and routed through the Senior Spill Team Captain to the HSE Library file where the records are maintained as long as personnel are assigned duties under the SRPP. The Spill Response Team training records include a summary of topics covered in the training session along with a brief description of any drills conducted with the training.

8.1.5 Qualified Individual Training

Upon learning of a spill or potential spill of oil or hazardous substance, the QI and Alternate QIs have to be able to communicate with the appropriate Federal, state and local officials and with the persons providing personnel and equipment for the spill response. Federal regulations require Emergency Response Plan holders to identify the type of training the QI receives. The goal is to ensure that the QI is fully capable to perform the required duties. The QI is not expected to be the expert in all areas of the Spill Plan, but to have sufficient knowledge of all aspects so that the Plan can be implemented in a timely manner.

The following QI training elements that apply to HRO are from the National Preparedness for Response Exercise Program (PREP) document on “Training Reference for Oil Spill Response” to demonstrate knowledge of:

- ✓ Notification procedures and the communication system used to make the notifications,
- ✓ Procedures used to mitigate or prevent discharge,
- ✓ Operational abilities of the OSROs that would respond to a spill at our facility for the different size discharges,
- ✓ Roles and responsibilities for the QI during and after a spill incident,
- ✓ Roles and responsibilities of the federal and state agencies during a spill incident,
- ✓ The contents of the EAP, which include worker safety, public affairs, crisis management. The EAP is based on the ICS,
- ✓ Procedures for obtaining approval for dispersant use,
- ✓ Protection of and damage assessment of sensitive biological areas, and
- ✓ The contents of the ACP and the NCP.

8.2 DRILLS

8.2.1 Qualified Individual Drill Notification

HRO conducts weekly emergency alert notification drills that test the entire emergency response system. One part of this test is a pager notification of all emergency and spill response personnel that includes the QI and the designated alternant. The system test is to ensure individual pagers are working properly. The SOC maintains records of the system tests, and the records are maintained in the HSE Library.

8.2.2 Emergency Response Team Drills

HSE conducts ERT drills to ensure an effective emergency response using the established ICS. Drills are conducted during quarterly emergency response training and are designated to cover the topics addressed in Section 8.1.2.

HSE Safety Representatives are responsible for monitoring drills. An ERT Drill Checklist illustrated in [Figure 8-1](#) is used to record observations regarding response effectiveness and deficiencies noted, and ERT personnel participating in the training are record in the ERT Training Documentation Form presented in [Figure 8-2](#).

Observations noted will be discussed at a post emergency response drill meeting to improve future response. Personnel attending the meeting will include responders involved directly in the drill.

8.2.3 Pipeline Spill Drills

As part of the ERT training discussed in Section 8.2.2, response to pipeline leaks and spills are also part of the overall training program. Drills are conducted during quarterly ERT training and are designated to cover the topics addressed in Section 8.1.2 that relate the pipelines. The monitoring and documentation procedures are given in Section 8.2.2.

8.2.4 Marine Spill Team Drills

The Spill Response Team conducts major equipment deployment drills semi-annually. The equipment deployed focuses on the use of boats and containment boom. This training serves to keep all members familiar with boat operations, boating safety, equipment handling and deployment, and improve team response.

An annual unannounced spill drill is conducted utilizing the Spill Response Team and the ICS addressed in the EAP. A specific spill scenario is developed for each unannounced drill. The Dock Spill Team will deploy major response equipment located at the Refinery and a spill response contractor included in the SRPP is activated during each annual

unannounced drill. The ICS is conducted concurrent with the field activities of the Dock Spill Team. An unannounced spill drill required by a Federal or State agency or the COTP may be substituted for the facility unannounced drill, if appropriate.

Key spill response personnel prepare a critique of each unannounced spill drill. This critique addresses the field activities of the Marine Spill Team and the tabletop exercise. The critique is distributed to all spill response personnel to evaluate and improve spill response where it is needed.

Records documenting all emergency response team notification system drills are maintained in accordance with the EAP. All records for the quarterly training and associated drills conducted by the Marine Spill Team are collected and routed through the Oil Movements Shift Supervisor to the HSE Library where the records are maintained as long as personnel are assigned duties under the SRPP. Quarterly Marine Spill Team drill records include a summary of the drill exercise along with the topics covered in the training session.

Records of each unannounced drill are routed by the Marine Operations Supervisor to the HSE Library where the records are maintained for a minimum period of 3 years. These records will include a description of the spill scenario, a list of all emergency response team personnel involved with the drill along with their respective job responsibilities, a complete record of the emergency response activities obtained from the documentation officer, and the drill critique.

8.2.5 Area Exercises

HRO participates actively in the CCA quarterly spill drills that exercise the response of member companies to respond to large oil spills. HRO's oil spill response contractor (Garner Environmental) is also a member and actively participates in these drills.

8.2.6 Triennial Exercise of the Entire Response Plan

Every 3 years all components of the entire response plan will be exercised. The PREP Guidelines allows the plan holder to exercise the individual components of the response plan over a 3 year period rather than hold a large drill once every 3 years.

The following are the basic types of plan components from the HRO Plan that will be exercised at least once every 3 years:

Organizational Design

- ✓ Notifications
- ✓ Staff Mobilization
- ✓ Ability to operate within the response management system described in the Plan

Operational Response

- ✓ Discharge Control
- ✓ Assessment of discharge
- ✓ Containment of discharge
- ✓ Recovery of spilled material
- ✓ Protection of sensitive areas
- ✓ Disposal of recovered material and contaminated debris

Response Support

- ✓ Communications
- ✓ Transportation
- ✓ Personnel Support
- ✓ Equipment maintenance and Support
- ✓ Procurement
- ✓ Documentation

The Plan will be exercised in segments over a period of 3 years, with each component of the Plan exercised at least once within the 3 year period. Response to an actual spill can be taken as credit for the items exercised, as long as they are evaluated. Proper records will be kept of each exercise and the documentation maintained in the HSE Library.

8.2.7 Summary

In the 3 year cycle, the following internal exercises will be conducted:

- ✓ 12 QI notification exercises;
- ✓ 3 spill management team tabletop exercises – one must involve the worst-case scenario;
- ✓ 3 unannounced exercises;
- ✓ Equipment deployment exercises as described below:
 - ✓ 6 facility owned and operated equipment deployment exercises (docks);
 - ✓ 3 OSRO equipment deployment exercises (docks);
 - ✓ 3 pipeline equipment deployment exercises;
- ✓ Triennial exercise of entire response plan.

The external Area exercises will be done in coordination with the CCA quarterly and annual drills. All drills will be documented and retained on file in HSE Library.

Figure 8-1 ERT Drill Checklist

Date:	
Evaluated by:	
Description of Drill (emergency type, location, conditions, etc.)	
Observation Point;	
Description of Events Observed:	
Time:	Observation:

Figure 8-1 ERT Drill Checklist

Was the initial response timely?

Did responders inspect and then don appropriate PPE?

What type of air monitoring was performed? Was it adequate?

Was proper equipment available?

Was the emergency area secured?

Were communications frequent and clear?

Did personnel evacuations go smoothly?

Were additional response resources made available?

Overall Comments:

Action Items:

Figure 8-2 ERT Training Documentation Form
ERT Training Documentation Form

Date: _____

Training Course: _____

Instructors: _____

Name	Team	Unit/Area	Job Position	Assignment	Signature
Abdual-Raheem, Herman	ID	Cokers	Shift Supervisor MERT		
Armstrong, John	Days	I&E Engineering	Electrician		
Arnold, Clint		HDS Complex	Operator	Lieutenant Rescue	
Auguillard, Ralph		SRC	Environmental Operator		
Bass, David	Y	737 Coker	Gang/Pool		
Bauerie, Richard		737 Coker	Gang/Pool		
Benoit, Patrick		737 Coker	Driller		
Blair, Jo Ann	A	Lubes	Shift Supervisor		
Bosler, Fabian	A	HDS Complex	Chief Operator		
Bottoms, Jon		737 Coker	Lead Operator		
Brown, Phil	A	SRU	Gatekeeper		
Caballero, Juan	D	HDS Complex	Area Supervisor		
Calvin, Ken	Days	HSE Tech Support	Security Representative		
Cantu, Luis	C	FCCU	Gang/Pool		
Carlisle, Steve	Days	736 Coker	PSM Supervisor		
Carmouch, Melvin	C	ARU	Shift Supervisor MERT		
Carter, Michael	B	736 Coker	Spotter	Lieutenant Spill	
Chavez, Robert	A	BRU	Merox Operator	Lieutenant Fire	
Clepper, David		BTU	Operator		
Coleman, Donald	Days	HSE Tech Support	Security Representative		
Collins, Kelvin		Oil Movements	Chemical Pumper		
Collins, Louis	D	Main/Engr/Services	Shift Electrician		

Figure 8-3 - Inspector Qualification Matrix

Inspection Type	Inspector Qualification or Training
Routine Visual	Operator with knowledge of tank, stored product and tank operation
External API 653 (in-service)	API 653 Certified Inspector
Ultrasonic Testing of Shell (In-service)	Level II or Level III of ASNT SNT-TC-IA (see API 650 paragraph 6.3.2, 10 edition, Addendum 3)
Internal API 653 (out-of-service)	API 653 Certified Inspector
Environmental Equivalency for Non-Destructive Shell Testing for shop-built tanks < than 30,000 gallons	Operator with knowledge of tank, stored product, and tank operation and Level II or Level III of ASNT SNT-TC-IA (for UT testing).
Environmental Equivalency for Non-Destructive Shell Testing for tanks storing products with heated tanks.	Operator with knowledge of tank, stored product, and tank operation

HSSE Emergency Action Plan (EAP)

[HSE-EAP-001 How to Report an Emergency](#)

[HSE-EAP-002 Emergency Notification and Response](#)

[HSE-EAP-003 Evacuation and Personnel Accounting](#)

[HSE-EAP-004 Emergency Site Security and Control](#)

[HSE-EAP-005 Emergency Operations Organization](#)

[HSE-EAP-006 Emergency Operations – Manufacturing](#)

[HSE-EAP-007 Incident Command System and Organization](#)

[HSE-EAP-008 Communications](#)

HSE-EAP- 009 Outside Notifications (future)

[HSE-EAP-010 Outside Resources and Mutual Aid](#)

[HSE-EAP-011 Training & Exercise Plan](#)

[HSE-EAP-012 Critique & Evaluation](#)

[HSE-EAP-013 Fire Response Plan](#)

[HSE-EAP-014 HAZMAT Response Plan](#)

[HSE-EAP-015 Emergency Medical Services Plan](#)

[HSE-EAP-016 Rescue Response Plan](#)

[HSE-EAP-017 Radiation Response Plan](#)

[HSE-EAP-018 Severe Weather Management](#)

[HSE-EAP-019 Bomb Threats](#)

[HSE-EAP-020 Civil Disturbance](#)

[HSE-EAP-021 Pandemic Preparedness and Response](#)

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-001	Page: 1 OF 3	Approval Date:	06/30/2011
Document Title:	HOW TO REPORT AN INCIDENT OR EMERGENCY				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

Any plant situation involving fire, injury or serious medical emergency, or any incident where the health or well-being of personnel or the environment may be impacted must be reported. When emergency situations occur, it is important that a response be made by trained personnel. Prompt and accurate reporting helps ensure that the proper response and follow-up are carried out.

INCIDENTS

An **incident** is limited in quantity, exposure potential, or toxicity. An incident poses no emergency or significant threat to the safety or health of employees in the immediate vicinity, even during clean up. A response to an incident can come from the immediate area utilizing equipment available in the area. Standard operating procedures will be followed for responding. Incidental spills that do not have the potential to develop into an emergency are covered under HAZCOM. Material Safety Data Sheets (MSDS) and HAZCOM manuals serve as a source for chemical-specific information. The environmental manual serves as a procedure and reference source.

An example of an incident would be a one pint spill of toluene under a lab hood in the laboratory. The quantity is low, the employee has knowledge of the chemical hazards, and a ventilation hood keeps employee exposure to a minimum.

EMERGENCIES

An **emergency** may include a fire, explosion, gas release, chemical spill or medical/rescue. An emergency response is required regardless of the surrounding circumstances and conditions. An emergency response includes, but is not limited to, the following situations:

- Resources are required from outside the immediate release area.
- Conditions require evacuation of employees in the area.
- Releases pose, or have the potential to pose, conditions that are immediately dangerous to life or health (IDLH).
- Releases require immediate attention because of imminent danger.
- There is uncertainty that the employees or equipment in the work area can handle the hazard.
- The situation is unclear or data is lacking on important factors.

INCIDENT AND EMERGENCY NOTIFICATION

"This is an electronically "Controlled" document. If printed this document is valid for 2 days from 04/11/13."

DOCUMENT NO:	HSE-EAP-001	PAGE:	2 of 3
DOCUMENT NAME: HOW TO REPORT AND INCIDENT OR EMERGENCY			

All Incidents must be reported through area supervision utilizing the cFlow FFR reporting process. See the *HSE Field Manual, Incident Reporting & Investigation* for further details.

All emergencies, regardless of their nature (safety, environmental, health or operational) must be reported to the Main Gate Dispatch. The preferred means for reporting emergencies is via telephone by calling **ext. 4444**. As an alternate, reporting by radio on the **(b) (7)(F), (b) (3)** is acceptable.

What to Report in an Incident or Emergency

- Your name and job title
- Phone number you are calling from
- Exact location and nature of the emergency or incident
- What product is involved
- What, if any, injuries there are (do not give names of injured)

In addition, the Main Gate Dispatch may ask additional questions in order to determine the appropriate response action.

Your Responsibility When Reporting

When reporting an incident or emergency, you should:

- ensure that all information is understood;
- stay on the line until dismissed by the dispatcher;
- provide as much information as possible;
- stay calm; and
- **pay attention to the dispatcher for any emergency action instructions.**

Upon receiving an incident or emergency report, the Main Gate Dispatch will initiate the appropriate response action.

DOCUMENT NO:	HSE-EAP-001	PAGE:	3 OF 3
DOCUMENT NAME:			
HOW TO REPORT AND INCIDENT OR EMERGENCY			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-002	Page: 1 OF 5	Approval Date:	06/30/2011
Document Title:	EMERGENCY NOTIFICATION & RESPONSE				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

EMERGENCY NOTIFICATION SYSTEM

The refinery Emergency Notification System (ENS) is used to advise personnel of emergency response and evacuation orders (See the [HSE-EAP-003 Evacuation and Personnel Accounting Procedure](#)).

The ENS is an integrated multi-media system designed for the purpose of communicating emergency messages to plant occupants. The system consists of tone, voice, and text messaging to a combination of sub-systems throughout the facility.

Upon notification of an emergency, the Main Gate Dispatcher activates the ENS. The ENS will provide information on the Alert level, type of emergency, location, and evacuation requirements. Additionally, the system is used to advise of any further special information. An All Clear is issued over the ENS to terminate the emergency.

The ENS may also be used to inform / notify personnel of refinery situations that they should be aware of, but do not meet the definition of an emergency (i.e., unit start ups and shut downs, adverse weather situations, etc.)

EMERGENCY CLASSIFICATION

Emergencies are classified by the level of response that is required and the type of emergency.

Responses are tiered into four alert levels. The level of a particular event is dependent on its magnitude from minor to serious. Each alert level activates emergency response groups according to predetermined response orders.

The type of emergencies may be either:

- Medical
- Rescue
- Fire
- Gas release
- Spill
- General emergency (i.e., weather event, power failure, process upset, etc.)

The Main Gate Dispatcher disseminates information provided and dispatches the appropriate level of Alert. After the initial Alert, the level may subsequently be escalated by the Plant Coordinator, the Incident Commander or the Field Coordinator.

DOCUMENT NO:	HSE-EAP-002	PAGE:	2 OF 5
DOCUMENT NAME: EMERGENCY NOTIFICATION & RESPONSE			

The tiered alert levels are defined below. General emergency management group response orders for each alert level are listed in [Appendix 1 - Response Classifications: Alert Levels](#).

ALERT 1: Medical, Rescue, Fire, Gas Release, or Spill

Minor emergency requiring only a limited emergency response. The impact of the event is contained to one source or within its area of origin. There is no potential for the incident to effect areas outside of the facility.

Examples of an Alert 1 emergency include, but may not be limited to, the following:

- Fires contained to one source or unit
- Minor spill or release which is confined within the area of origin
- Medical emergency with less than three (3) injuries or illnesses
- Malfunction or damage of radiography equipment unshielding source

ALERT 2: Medical, Rescue, Fire, Gas Release, or Spill

Emergency requiring activation of the Emergency Operations Center due to

- Actual or potential for off-site impact
- News media coverage
- The need for additional emergency management, technical or logistical support
- Significant regulatory agency involvement

Examples of an Alert 2 emergencies include, but may not be limited to, the following:

- Explosion and fire impacting more than an isolated area
- Major spill or release that is or may impact areas outside of facility
- Medical emergency with more than three (3) serious injuries or illnesses
- Incident involving a fatality
- Incident involving multiple units or buildings

ALERT 3: Medical, Rescue, Fire, Gas Release, or Spill

Emergency requiring activation of off-site emergency response team members and all emergency management support and resources.

Examples of an Alert 3 emergency include, but may not be limited to, the following:

- Major fire or explosion affecting a large area
- Fully involved fire in a large storage tank
- Major spill or release impacting areas outside of facility
- Mass casualty medical emergency
- Emergency of a long duration or other circumstances that make additional responders necessary

DOCUMENT NO:	HSE-EAP-002	PAGE:	3 OF 5
DOCUMENT NAME: EMERGENCY NOTIFICATION & RESPONSE			

ALERT 4: Medical, Rescue, Fire, Gas Release, or Spill

Emergency requiring outside mutual aid assistance and support.

An Alert 4 activates resources from Channel Industries Mutual Aid (CIMA). The Main Gate Dispatcher or Incident Commander activates the CIMA predetermined list as indicated below:

- CIMA first, second or third alarm
- CIMA Mass Casualty Incident: MCI-10, MCI-20 or MCI-30

Note that a CIMA "Special Call" does not in and of itself constitute an Alert 4 Response.

ALL CLEAR

When the emergency is over and it is safe for personnel to return to normal work activity, Main Gate Dispatch will activate the "All-Clear" via the ENS.

SRU THERMAL OXIDIZER / FLARE RELEASES

The Plant Shift Superintendent is responsible for ensuring that appropriate responses are made to SRU incinerator or flare releases.

Incinerator or flare releases, which may affect or are affecting the refinery or areas outside the plant boundaries, shall be alerted according to the alert levels described above. Those events that impact or are visible to areas outside of the refinery, should result in consideration of community notification via the CAER Line.

Effect or impact from SRU releases may be determined using known facts and observable information as follows:

- SRU Operating conditions
- H₂S and SO₂ Emissions Analyzer data
- Visual observations
- Atmospheric conditions

DOCUMENT NO:	HSE-EAP-002	PAGE:	4 OF 5
DOCUMENT NAME:			
EMERGENCY NOTIFICATION & RESPONSE			

Appendix 1 Response Classification Alert Levels

Response Classification	Type of Emergency	Response
Alert 1 Minor Emergency Limited Response	Medical	ERT Battalion Rescue Team (On-Shift) ERT Officers Medical HSE Security (On-Shift)
	Rescue	Same as Alert 1 Medical response
	Fire Gas Release Spill	ERT (On-Shift) ERT Officers HSE On-Call Personnel HSE Security (On-Shift)
	Radiation	ERT Officers HSE On-Call Personnel HSE Security (On-Shift)
Alert 2 Emergency Management Support Resources (EOC)	Medical	Alert 1 medical PLUS Emergency operations (EOC)
	Rescue	Alert 1 Rescue PLUS Emergency operations (EOC)
	Fire Gas Spill	Alert 1 Response PLUS Emergency operations (EOC) HSE (All)
	Radiation	Alert 1 Radiation Response PLUS Emergency operations (EOC)
Alert 3 All Emergency Resources	Medical Rescue	Alert 2 Response PLUS: ERT Day Team (On-Call) ERT Battalions (Off-Shift)
	Fire Gas Release Spill	
Alert 4 Mutual Aid and Outside Resources	Medical Rescue	Alert 3 Response PLUS CIMA Alarm List or MCI activation Other mutual aid as requested
	Fire Gas Release Spill	

DOCUMENT NO:	HSE-EAP-002	PAGE:	5 OF 5
DOCUMENT NAME:			
EMERGENCY NOTIFICATION & RESPONSE			

REVISION SUMMARY

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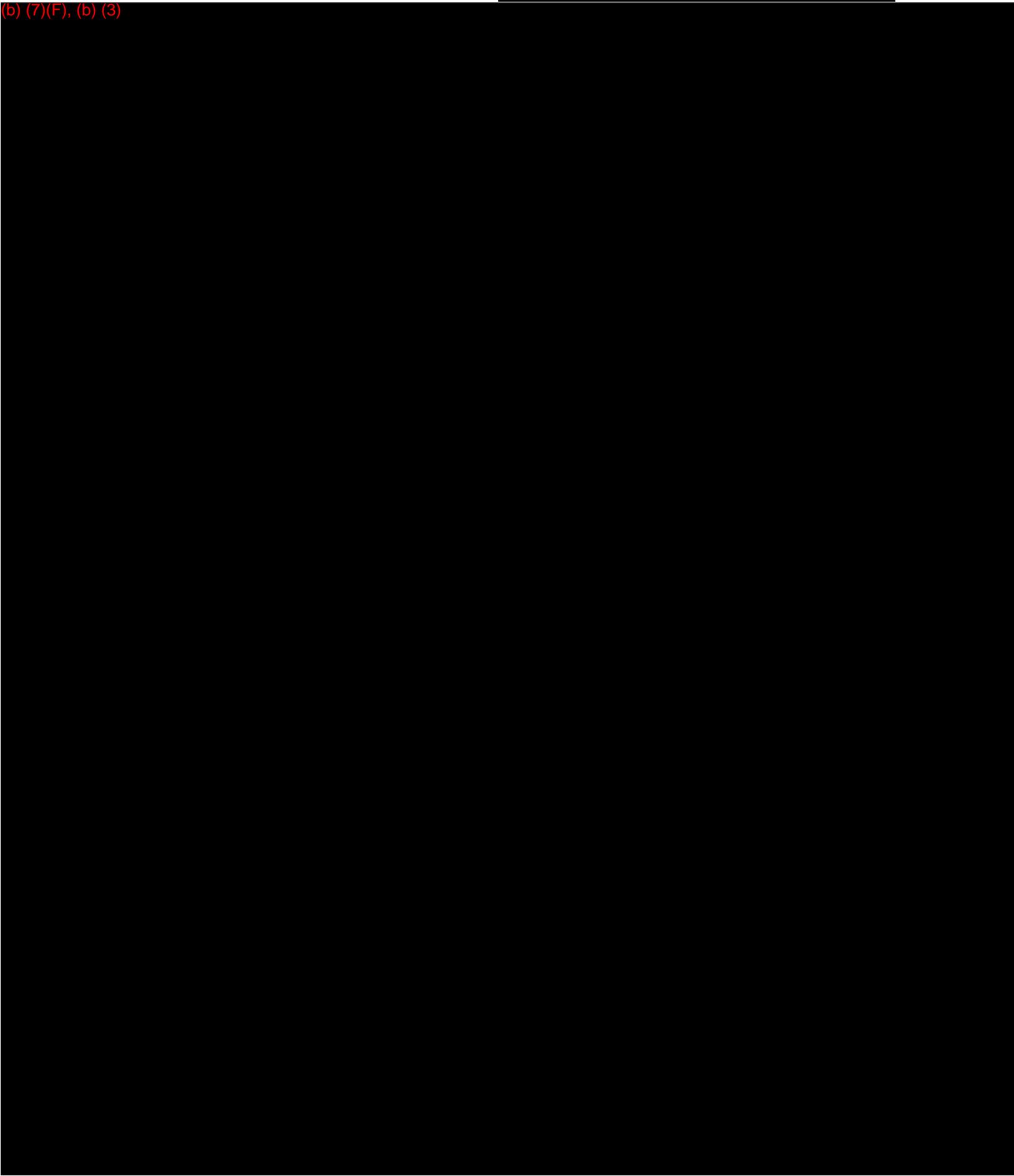
HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-003	Page: 1 OF 15	Approval Date:	06/30/2011
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TABLE OF CONTENTS

Summary	2
Scope	2
Definitions	2
Roles and Responsibilities	3
Procedure	5
Evacuation	5
Reporting Accountability	5
Facility Emergency Evacuations	6
Non-Essential Personnel Evacuate the Unit / Area	6
Non-Essential Personnel Plant-Wide Report to Rally Points	7
All Personnel Evacuate the Unit / Area	7
All Personnel Plant-Wide Report to Evacuation Points	8
Supplemental Evacuation Orders	8
Communication with Evacuation Points	9
Building Fire Evacuations	10
Shelter in Place	10
Training	11
Appendix 1 - Refinery Evacuation Map	12
Appendix 2 - List of Accountability Readers and Evacuation Points	13
Appendix 3 - Special Situation Clarifications	14
Calpine Channel Energy Center	14
Personnel working at the Docks (HRO and non-HRO Personnel)	14
Personnel working in Remote Tank Farms	14
Revision Summary	15

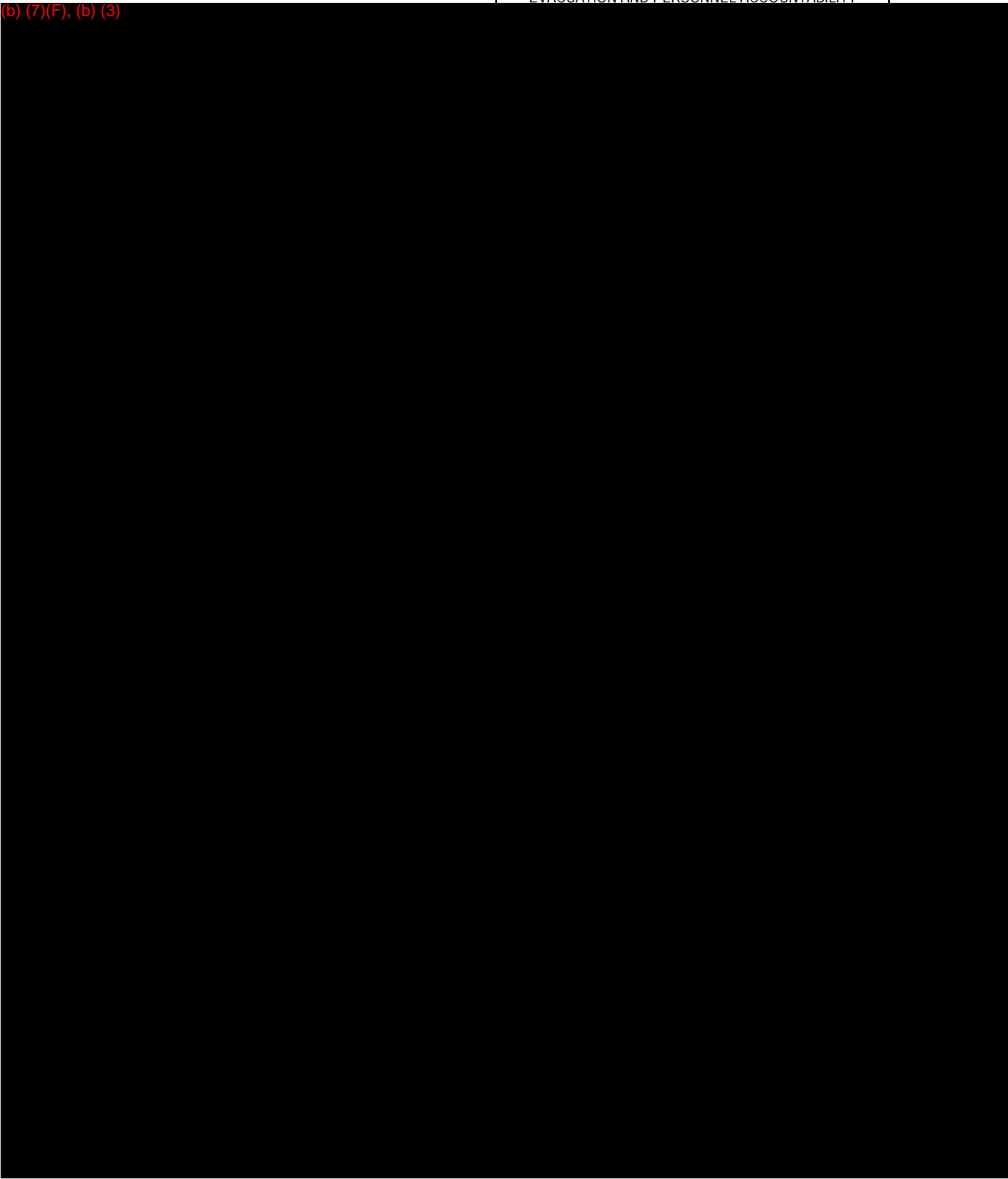
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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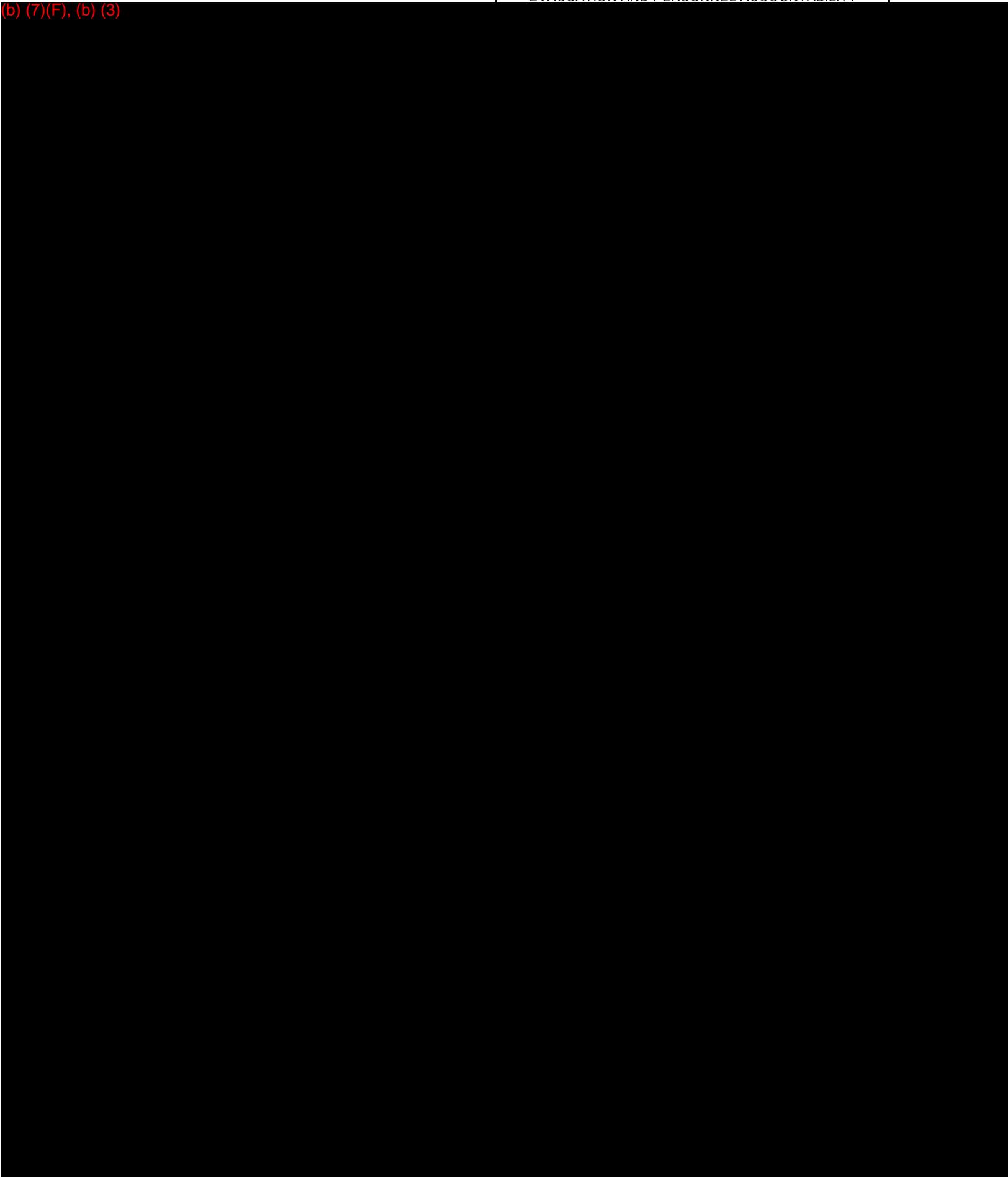
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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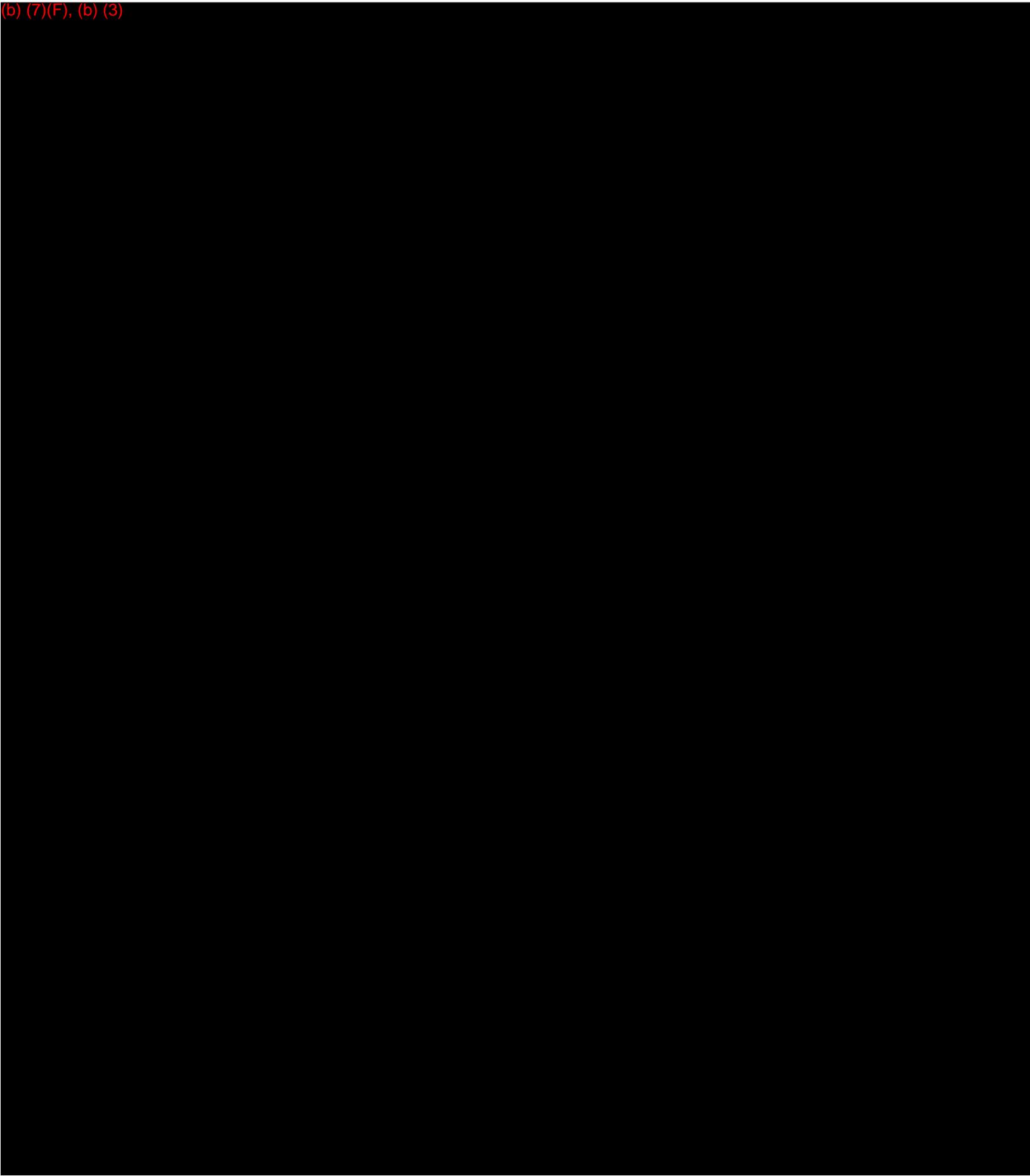
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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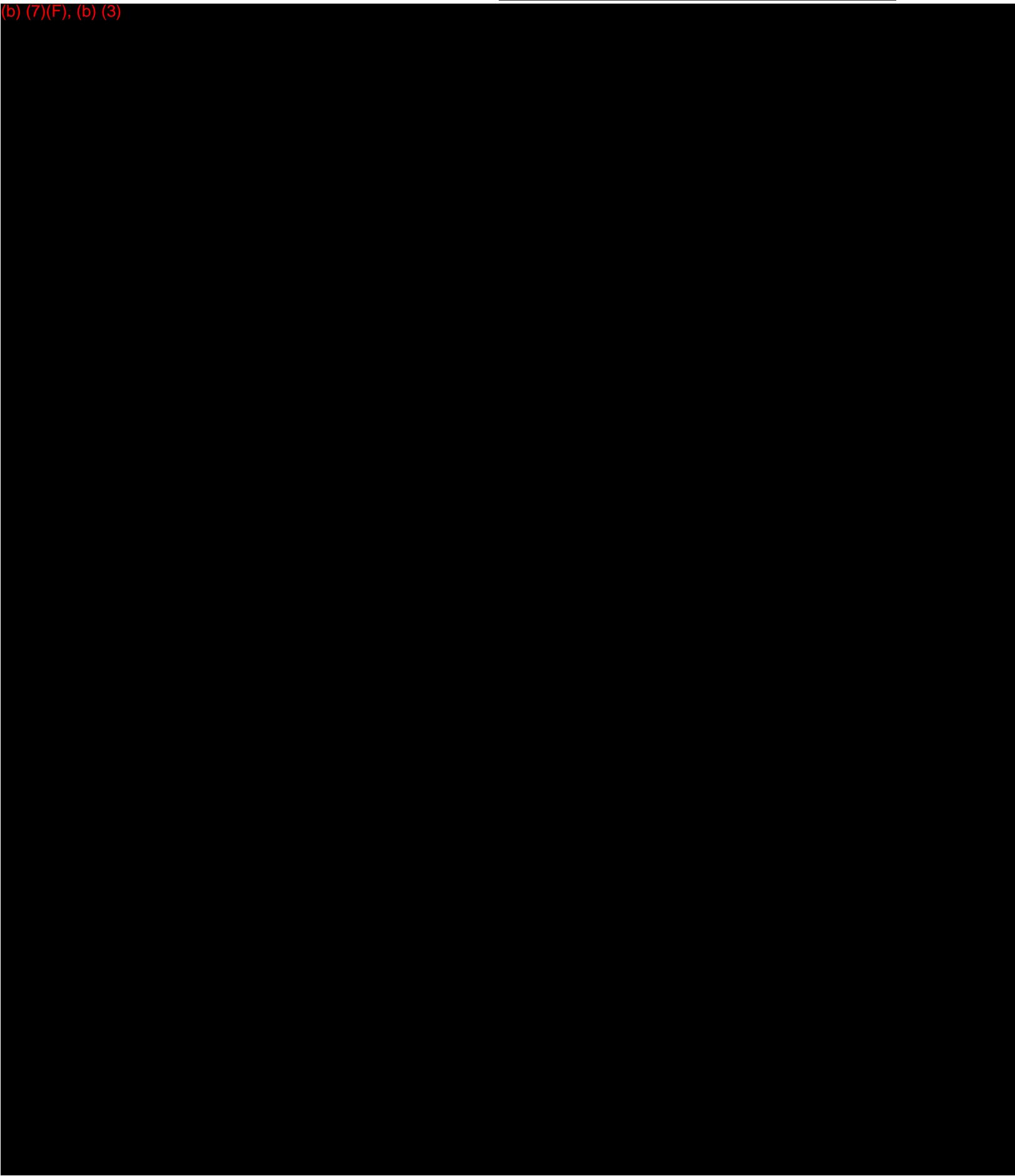
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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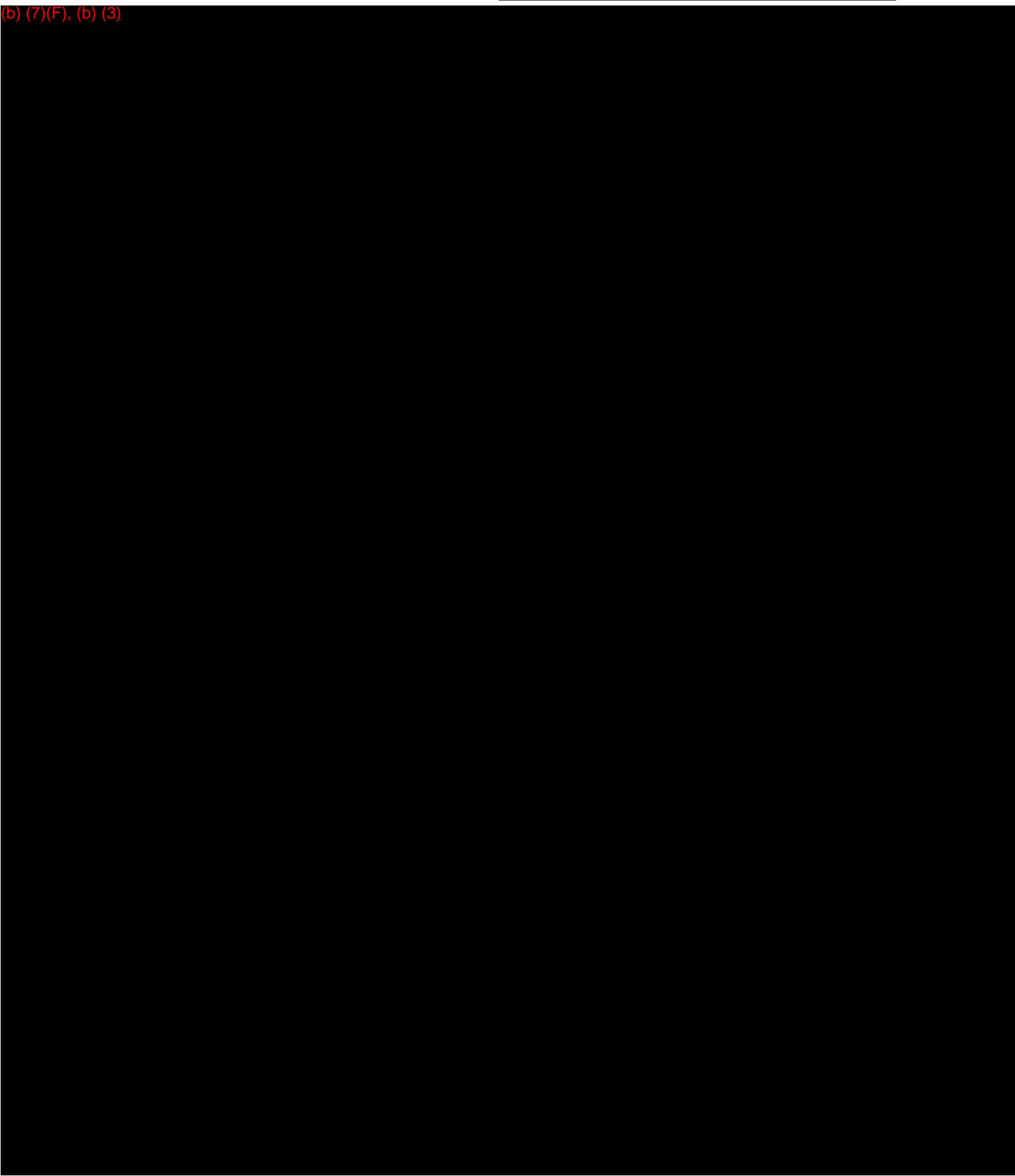
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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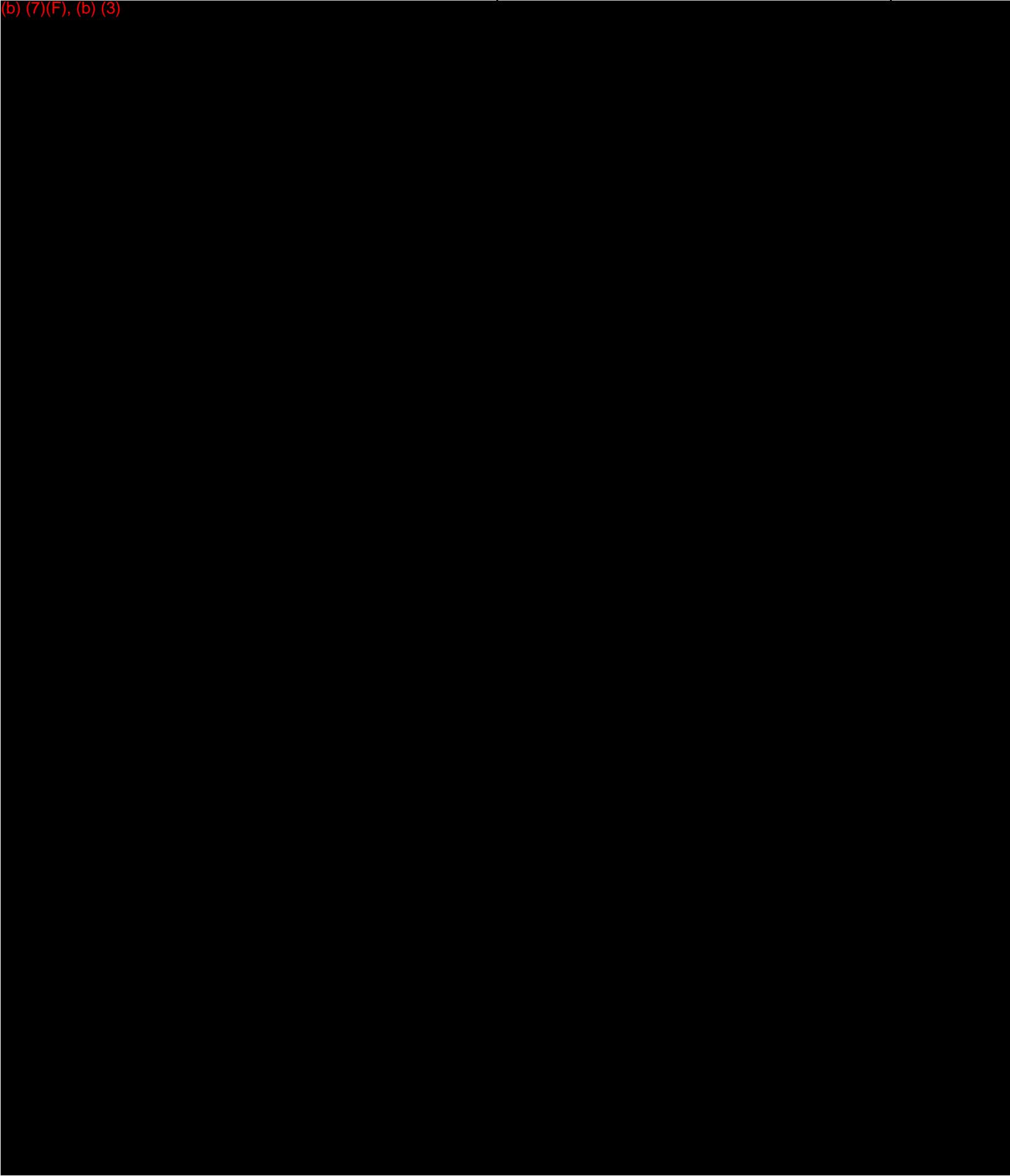
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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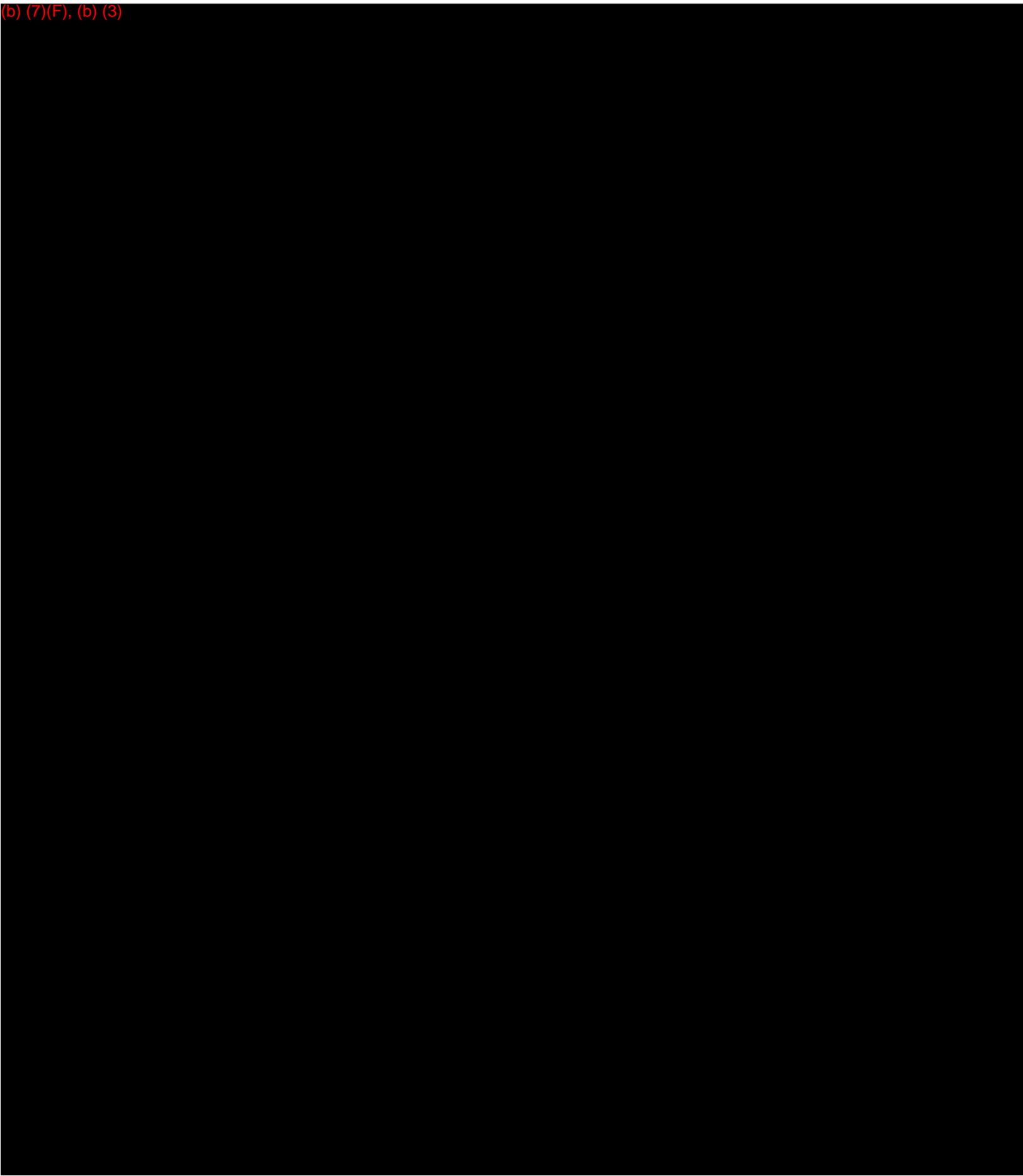
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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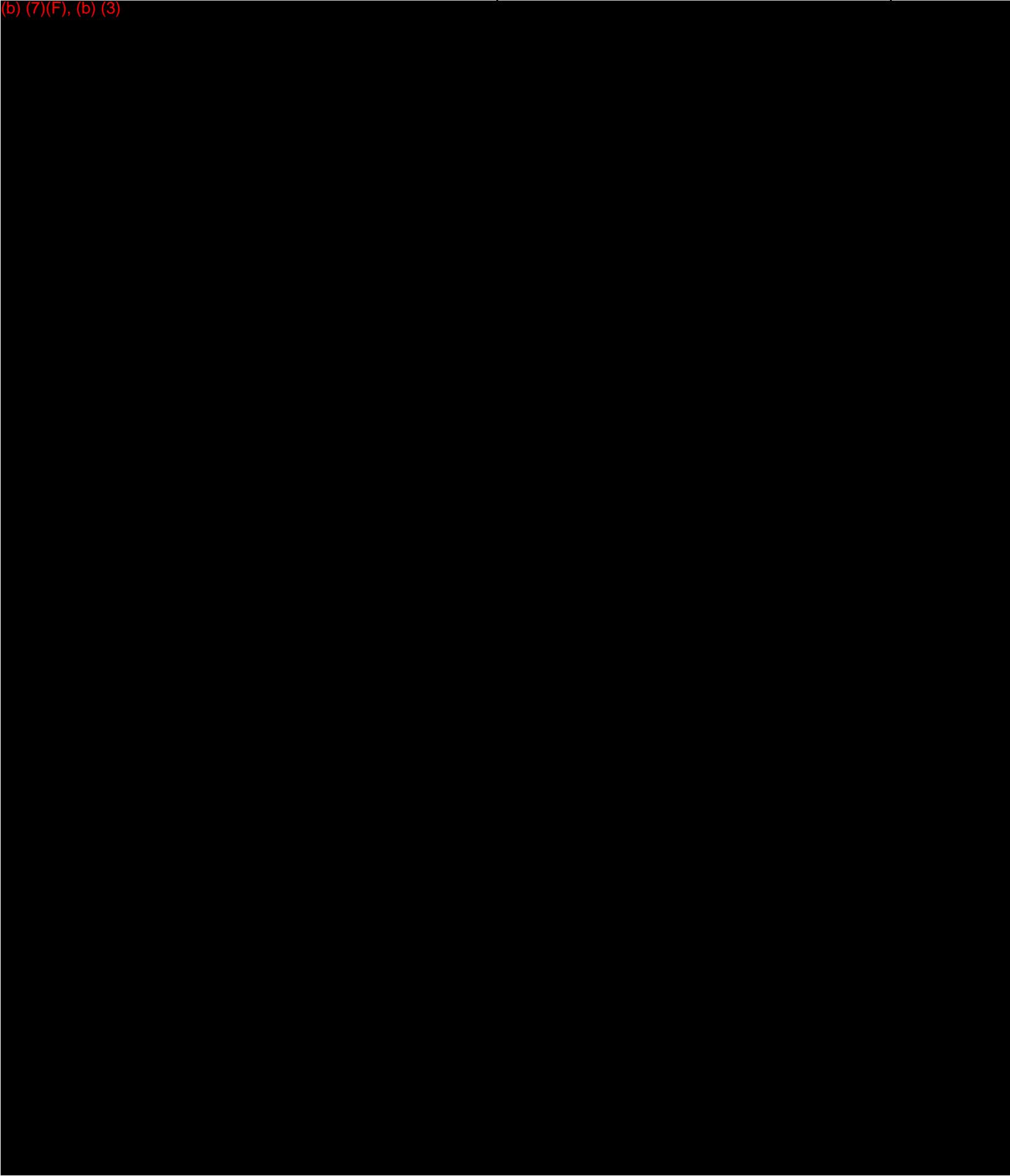
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-003	PAGE:	10 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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DOCUMENT NO:	HSE-EAP-003	PAGE:	11 OF 15
DOCUMENT NAME: EVACUATION AND PERSONNEL ACCOUNTABILITY			

TRAINING

Houston Refinery Employees shall be provided with training on this procedure at initial job assignment, with changes in job assignment / location and annually thereafter.

Visitors / Vendors / Delivery Drivers, etc. will be provided an overview of this procedure as part of their site orientation prior to entry.

DOCUMENT NO:	HSE-EAP-003	PAGE:	12 OF 15
DOCUMENT NAME: EVACUATION AND PERSONNEL ACCOUNTABILITY			

APPENDIX 1

Houston Refinery Evacuation Map

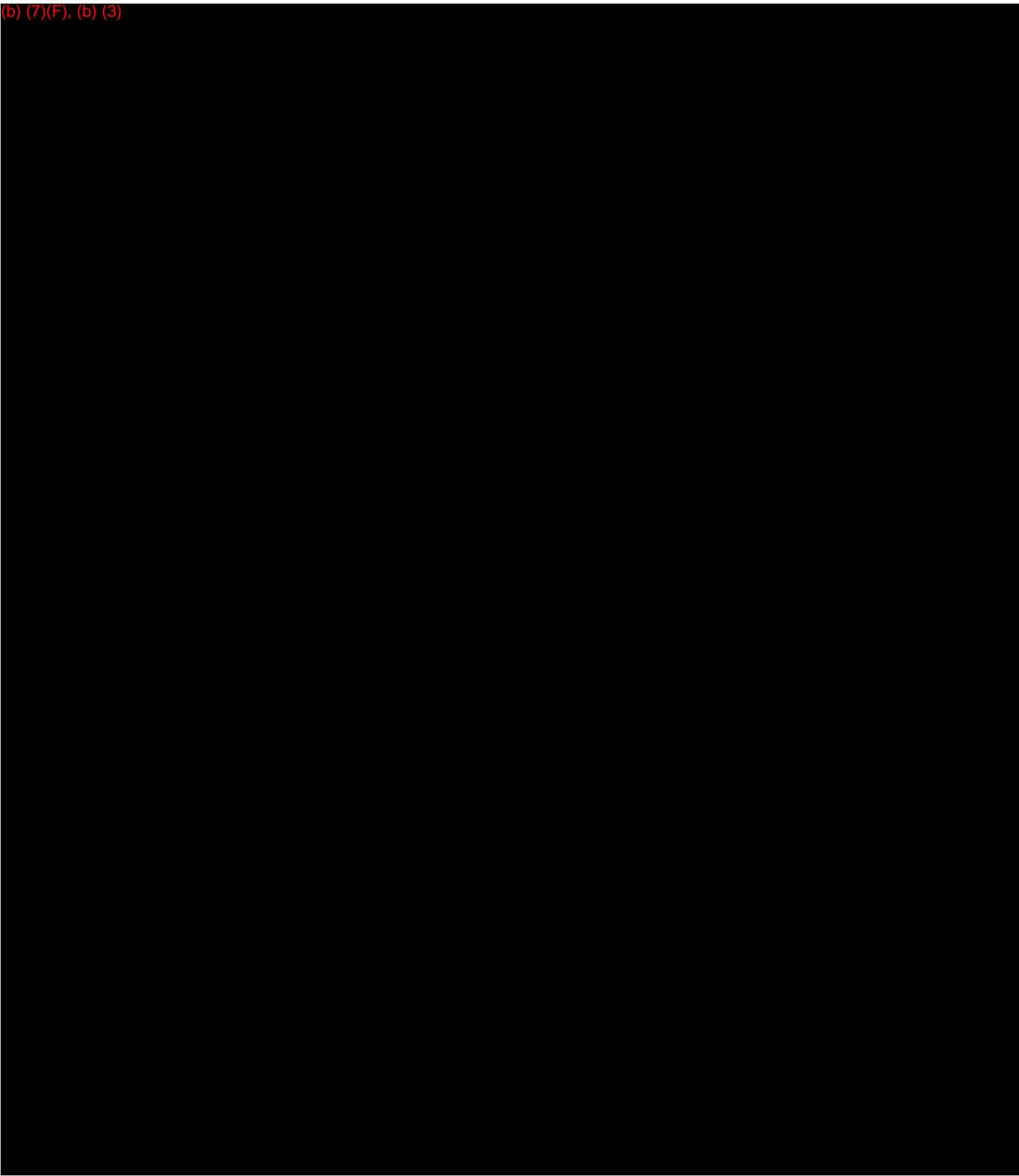


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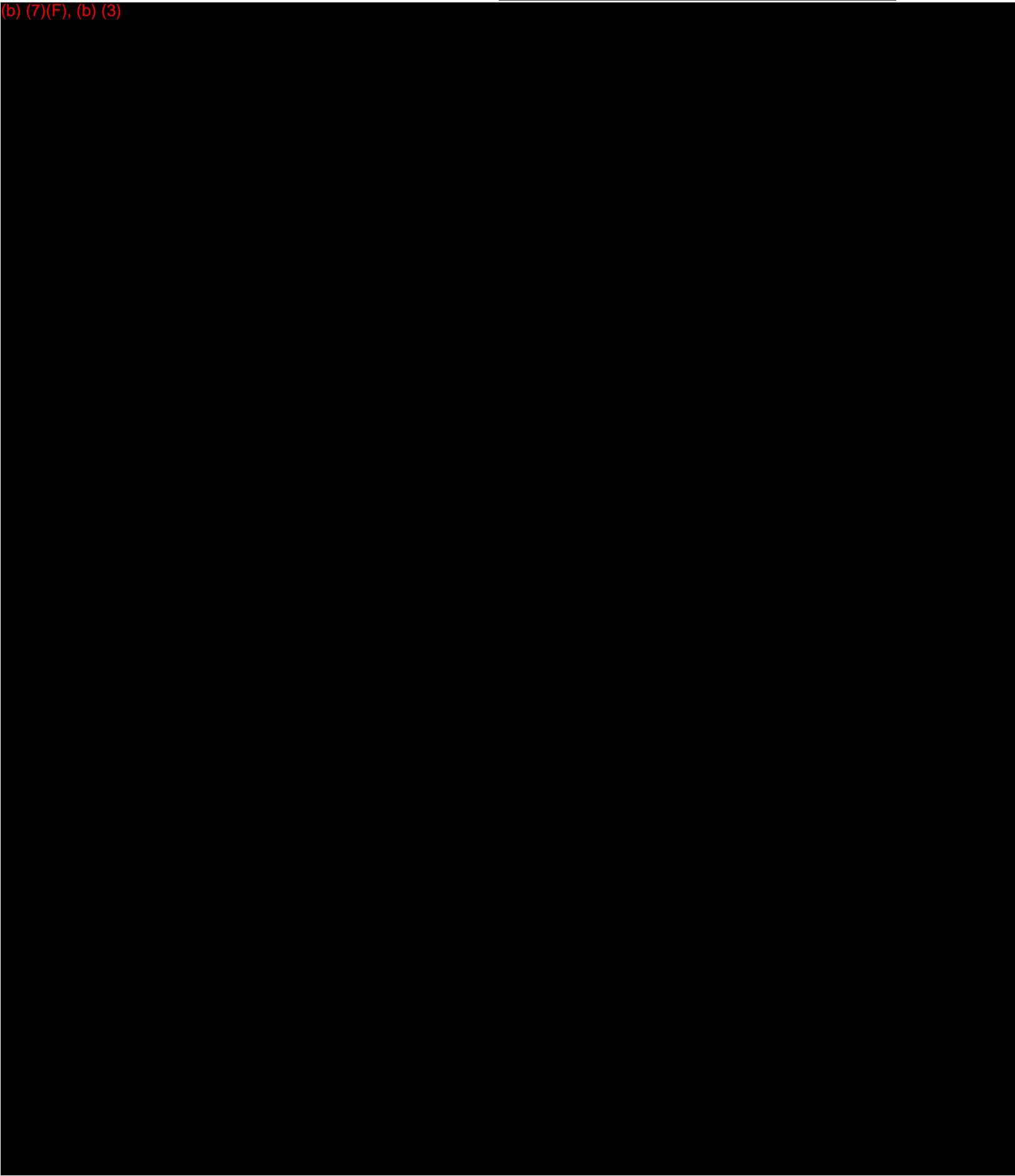
DOCUMENT NO:	HSE-EAP-003	PAGE:	13 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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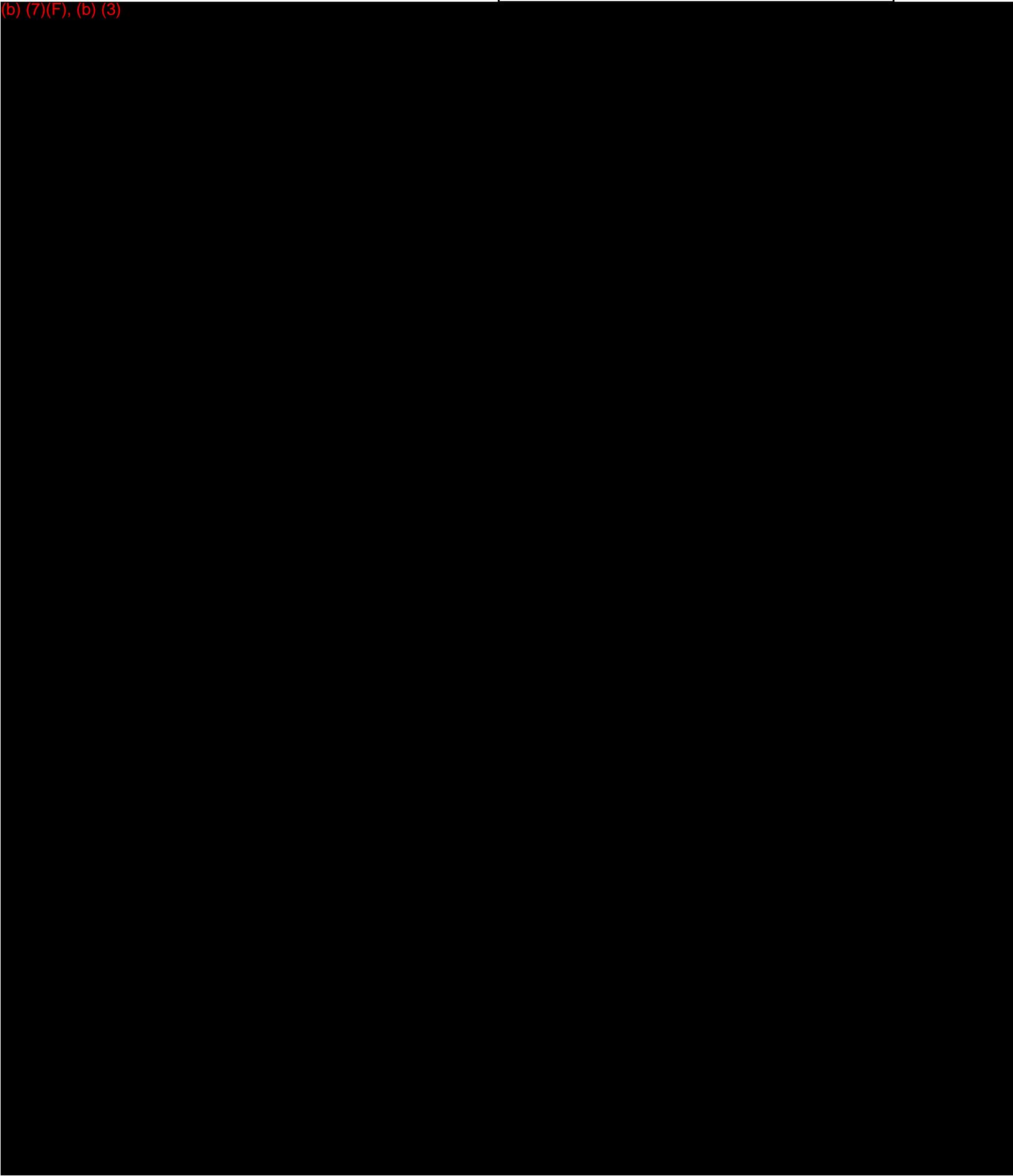
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DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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DOCUMENT NO:	HSE-EAP-003	PAGE:	15 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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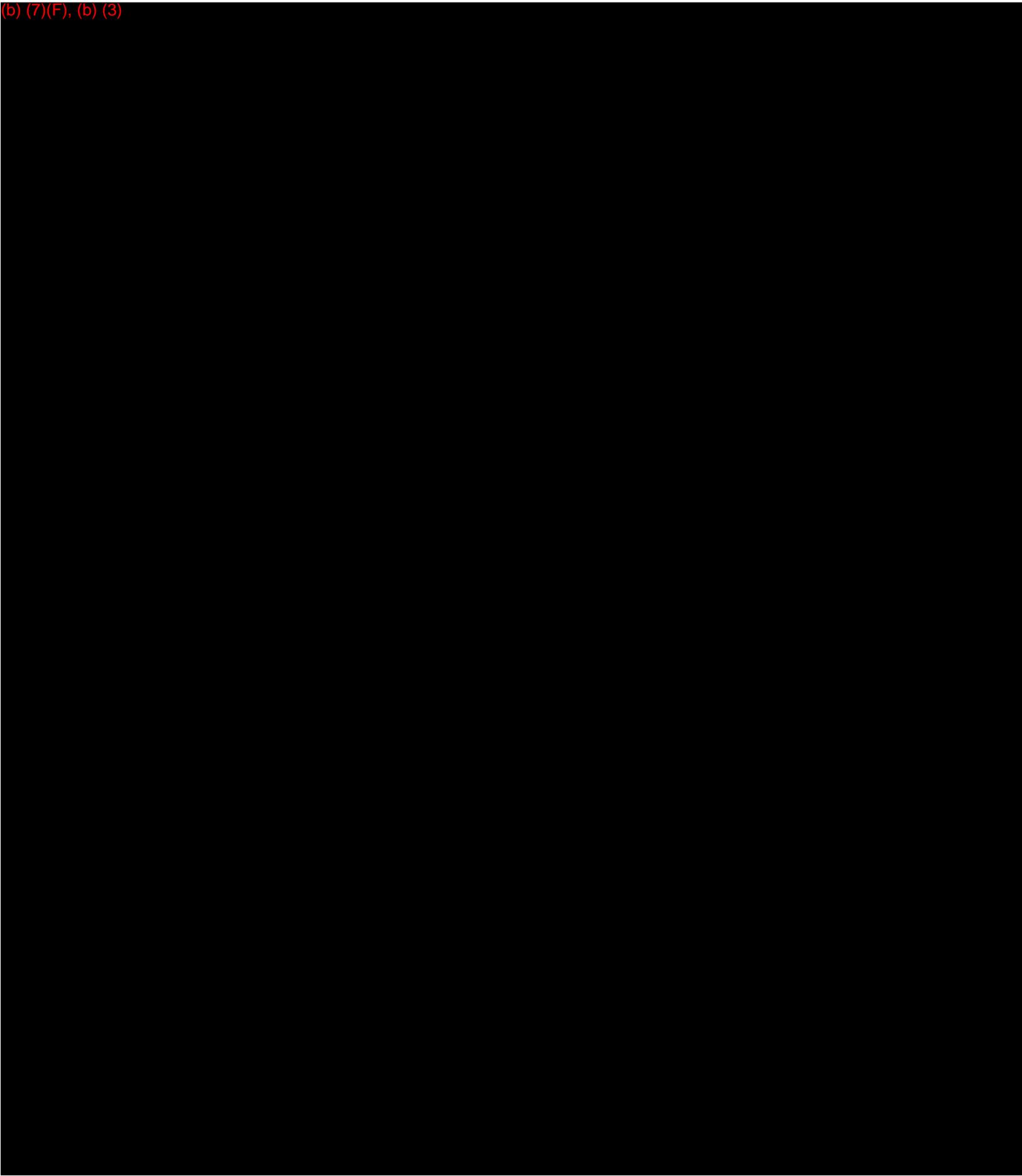
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SITE CONTROL

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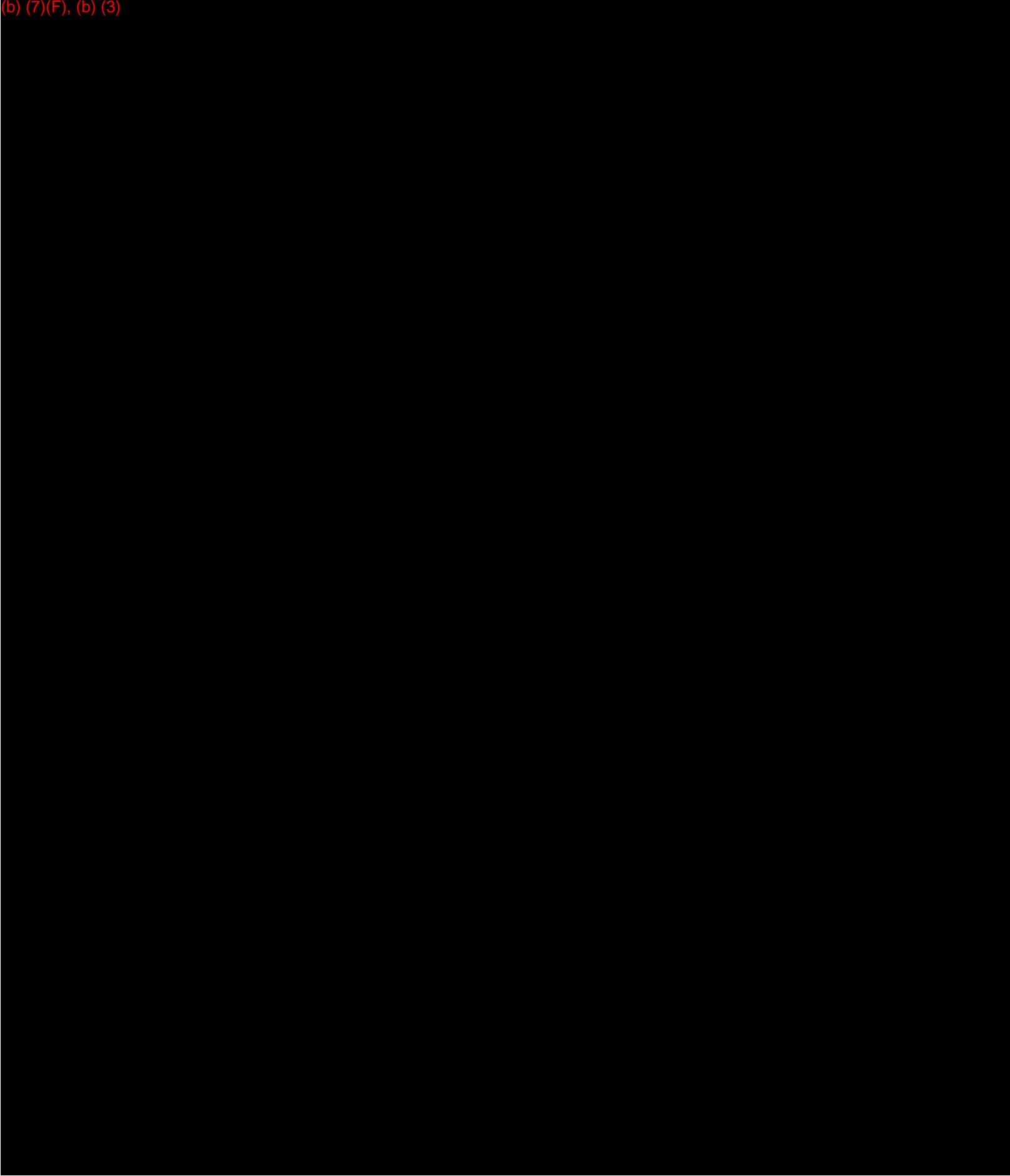
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DOCUMENT NAME:			
EMERGENCY SITE SECURITY AND CONTROL			

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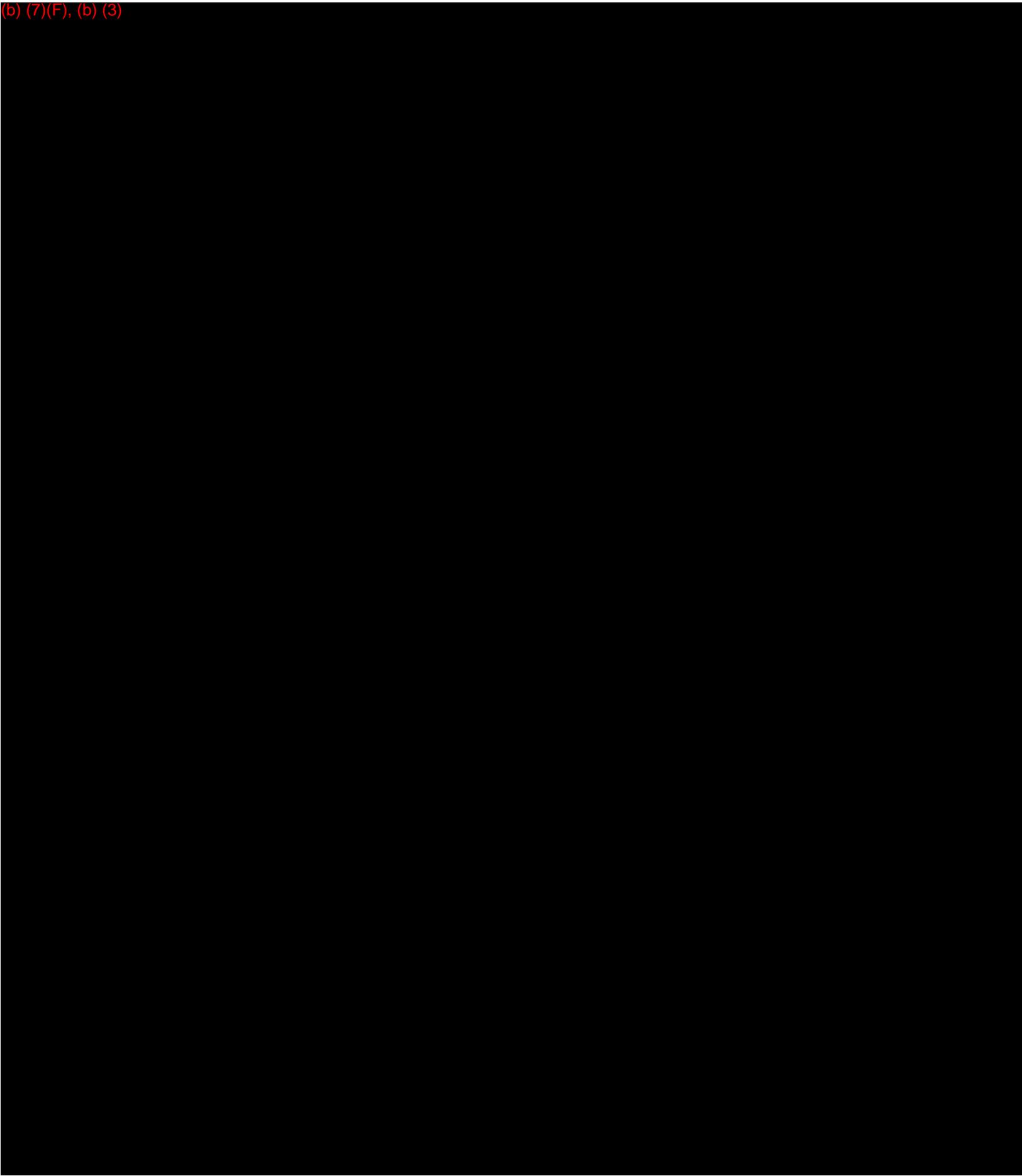
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DOCUMENT NAME:			
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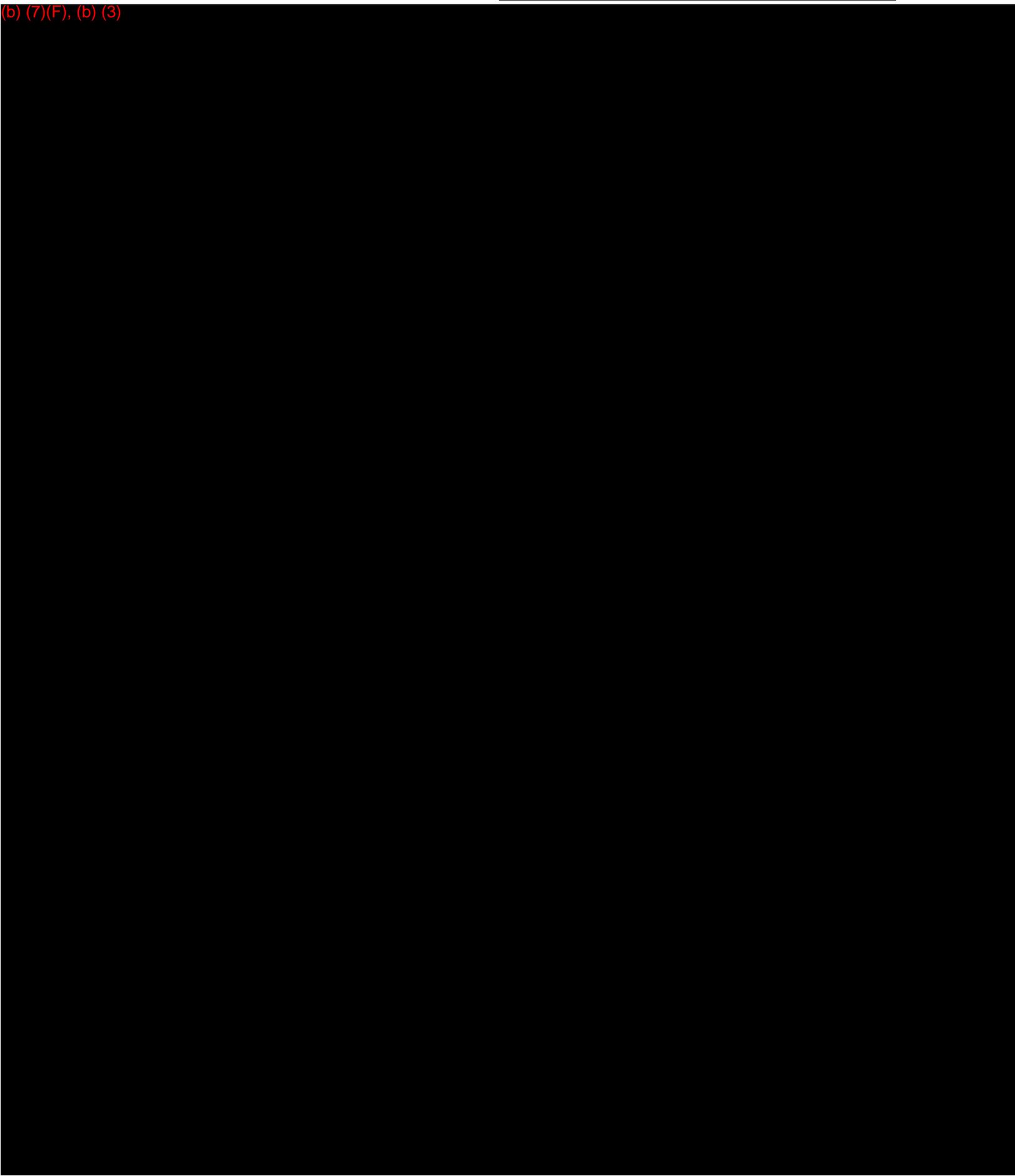
DOCUMENT NO:	HSE-EAP-004	PAGE:	4 OF 5
DOCUMENT NAME:			
EMERGENCY SITE SECURITY AND CONTROL			

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DOCUMENT NO:	HSE-EAP-004	PAGE:	5 OF 5
DOCUMENT NAME: EMERGENCY SITE SECURITY AND CONTROL			

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TABLE OF CONTENTS

Summary	2
Scope and References	3
Definitions	4
Flow Chart	5
Procedure	7
Emergency Operations Director	7
Public Information Officer	12
Legal	12
Operations Coordinator	16
Technical Support Unit	16
Operations Planning	17
HSSE Coordinator	24
Environmental Support Unit	24
Security Support Unit	24
Documentation Unit	25
Human Resources Coordinator	35
Facility Accountability Coordinator	35
Site HR Unit	35
Employee Relations Unit	35
Benefits / Employee Assistance Unit	35
Logistics Coordinator	48
Electrical Engineering Services	48
Maintenance Services	49
Maintenance Engineering Services	49
Facility Services	49
Supply Unit	49
Revision Summary	60

DOCUMENT NO:	HSE-EAP-005	PAGE:	2 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

SUMMARY

The **Emergency Operations** group provides support to emergency field efforts and to refinery operations from the EOC and other associated facilities. Support efforts include high level strategic planning, coordination of resources, recovery planning and business actions produced by an emergency event. Their planning and support efforts provide the strategic direction and support necessary to effectively mitigate the adverse consequences of events posing a threat to the well being of the company, employees or the community.

The refinery Emergency Management Organization is divided into four areas. The areas are:

- Emergency Operations (EOC)
- Emergency Operations - Manufacturing
- Emergency Response – Field Command
- Emergency Response – Operations

The **Emergency Operations - Manufacturing** group provides direct process operations control of the emergency scene and other refinery operations. The group manages emergency response strategic efforts relating to affected unit operations, emergency shutdowns and emergency response.

Emergency Response – Field Command provides overall on-site direction of emergency response efforts. Command efforts include defining objectives, establishing priorities and allocating resources. Incident Command, working in conjunction with manufacturing, sets strategic priorities for managing the incident.

The **Emergency Response - Operations** group provides the tactical direction for the Emergency Response Team. The Emergency Response Team (ERT) provides emergency fire, hazard control, medical and rescue services to the facility.

The respective support areas are organized in the following groups:

- Operations Planning and Support
- HSSE Support
- Human Resources Support
- Logistics Support

DOCUMENT NO:	HSE-EAP-005	PAGE:	3 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

SCOPE AND REFERENCES

This procedure applies to all emergency situations that may occur throughout the Refinery. This program is established to ensure compliance with OSHA requirements:

29 CFR 1910.38 Employee Emergency Plans and Fire Prevention Plans

29 CFR 1910.119(n) Process Safety Management of Highly Hazardous Chemicals (Emergency planning and response)

29 CFR 1910.120(q) Hazardous Waste Operations and Emergency Response (Emergency response to hazardous substance releases)

29 CFR 1910.156 Fire Brigades

Emergency Alerts

Emergency Operations and their functional teams are activated during an Alert 2 or greater event.

Other Emergency Operations Activations

For refinery events or incidents that may not demand an Alert activation, include, but may not be limited too, security events, bomb threats, or serious operational upsets. Emergency Operations may be activated by the Plant Shift Superintendent, a Superintendent or a Manager.

Reporting Locations

The Director and Coordinators of Emergency Operations and other designated positions report to the EOC. Some Emergency Operations positions report to other locations as designated in this plan.

Check In

On arrival to their reporting location, responders shall check in as per their reporting assignment. Check in includes establishing communications per job duties and responsibilities.

DOCUMENT NO:	HSE-EAP-005	PAGE:	4 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

DEFINITIONS

Affected Unit or Area - A process manufacturing unit, tank farm, or loading facility that is experiencing an emergency event (fire, spill, and gas release).

Emergency Operations Center (EOC) – The physical location at which the coordination of information and resources to support incident management (on-scene and offsite) and planning activities takes place.

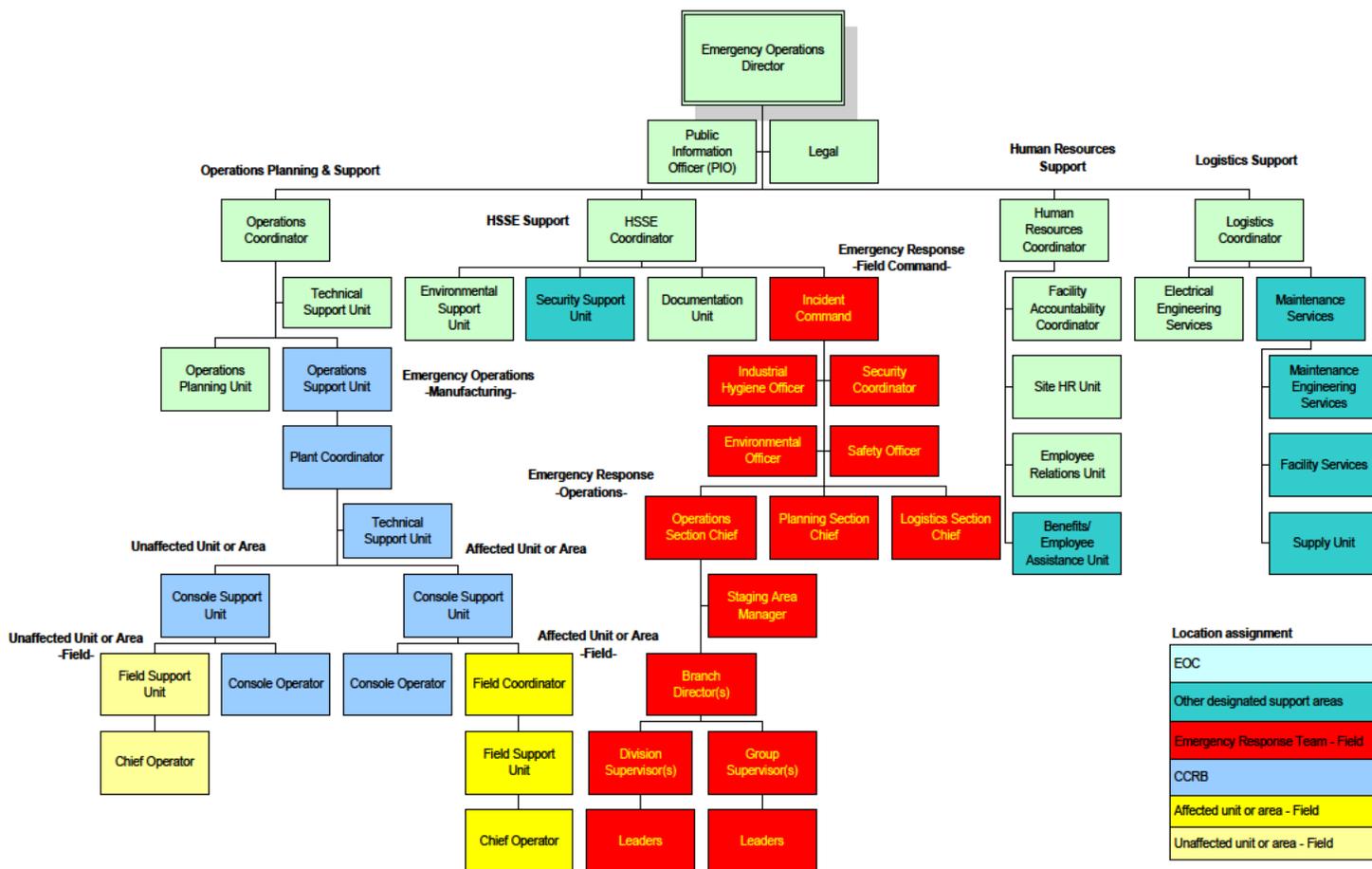
Field Command Post (FCP) or Incident Command Post – The field location where the primary functions of incident management are performed. The FCP may be located in a command support or mobile command van.

Unaffected Unit or Area – A process manufacturing unit, tank farm or loading facility that is not directly affected by an emergency in the facility but may be required to perform operational adjustments and changes.

DOCUMENT NO:	HSE-EAP-005	PAGE:	5 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

FLOWCHART

Emergency Management Organization



Location assignment

EOC
Other designated support areas
Emergency Response Team - Field
CCRB
Affected unit or area - Field
Unaffected unit or area - Field

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DOCUMENT NO:	HSE-EAP-005	PAGE:	6 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

EMERGENCY OPERATIONS CENTER (EOC)

An EOC is activated: To support the on-scene response and manage offsite concerns during an escalating incident by relieving the burden of external coordination and security from field emergency resources.

An EOC is:

- A physical location.
- Staffed with personnel trained for and authorized to represent their discipline.
- Equipped with mechanisms for communicating with the incident site and obtaining resources and potential resources.
- Managed through objectives and defined duties/responsibilities.

An EOC consists of: Personnel and equipment appropriate to the level of the incident.

An EOC is used: To provide coordination, direction and support during emergencies.

An EOC may: Facilitate functions and support Incident Command when resource needs exceed scene capabilities.

An EOC does not: Command the on-scene level of the incident.

Primary EOC Location

The **primary EOC** is located in the **Main Office Building, East Wing, Second Floor, HSE Emergency Services.**

Alternate Location

If the primary EOC is rendered unusable due to damage, an alternate location will be used.

The alternate EOC is the **HRO Training Center, located on Allen Genoa St.**

GENERAL

During the activation of an Alert 2 or greater event, the first team member to arrive at EOC will assume the Emergency Operations Director position and establish control of the center's activities.

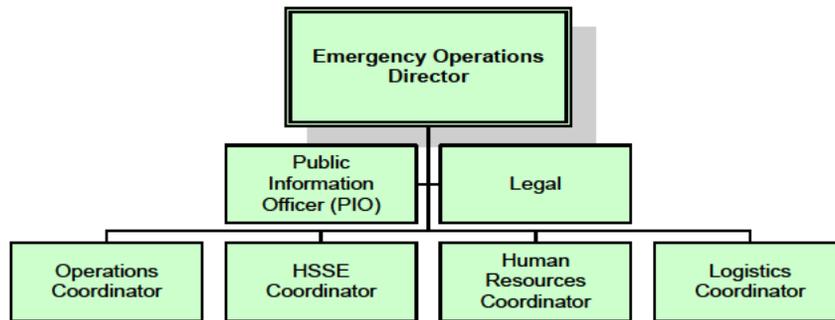
Coordinators assume their assigned duties, establish communications, and activate their functional plans with their Teams.

Other Team members, reporting to EOC, will staff their positions and assume their duties and responsibilities.

DOCUMENT NO:	HSE-EAP-005	PAGE:	7 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

EMERGENCY OPERATIONS

EMERGENCY OPERATIONS DIRECTOR



The Emergency Operations Director provides management leadership to the group and the refinery. The primary responsibility of the Emergency Operations Director is to lead coordinated efforts in addressing facility planning and support issues.

The Emergency Operations Director is responsible for communications to corporate and the requesting of corporate support resources.

The Emergency Operations Director leads and directs management support and planning efforts. For the Emergency Operations group, the Director establishes objectives, develops strategies, issues assignments and ensures joint planning/integration of tactical operations. The Emergency Operations Director evaluates the current situation and ensures that current planning is adequate.

The Director communicates directly with their Staff and the Coordinators in EOC. Additionally, the Director communicates with the Divisional Vice President.

The Director is responsible for alerting Company Officials of a Crisis and may request Company resources to assist in response efforts.

DOCUMENT NO:	HSE-EAP-005	PAGE:	8 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

CRISIS IDENTIFICATION AND INITIAL RESPONSE

A "crisis situation" is any unplanned event that has a major impact on the company, its employees, or the public. A "crisis" significantly interrupts the operations or conduct of business; requires immediate coordinated management response; and requires immediate decision-making from an executive level. This includes events which may be external to the company and its facilities, but which have the potential to quickly focus extensive news media and public attention on the company.

Indication that there is the potential for any of the following to occur should initiate an evaluation to determine whether a potential for a "crisis situation" exists.

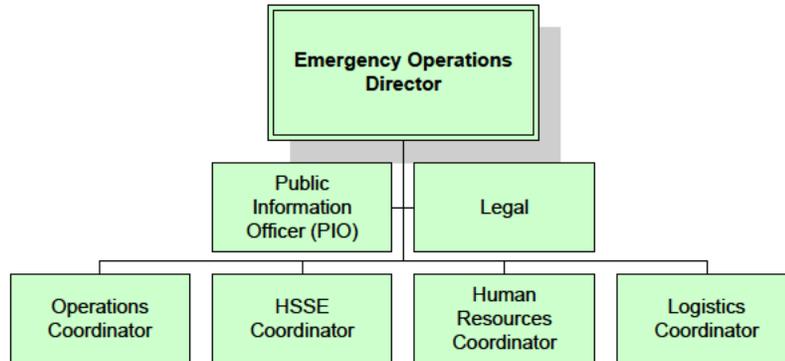
- Fatalities or serious injuries.
- Fire or explosion resulting in substantial property damage.
- Potential for significant environmental damage.
- The release of or exposure to a material which could pose a threat to the health and safety of employees or residents of the community or result in adverse environmental impact.
- Significant transportation incident or marine spill involving raw materials purchased for, or finished products produced by the Company.
- Significant interruption or loss of operations at a manufacturing facility.
- Labor dispute that has the potential to result in an interruption of operations.
- Terrorist threat or security-related risk.
- Major media coverage.
- Loss of critical information processing systems.
- Employee/workplace violence.

"Crisis situations" must be reported immediately to the "Crisis Notification Line", See [Duties and Responsibilities: Emergency Operations Director](#).

DOCUMENT NO:	HSE-EAP-005	PAGE:	9 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

PROCEDURE

EMERGENCY OPERATIONS DIRECTOR



Assignment:	<ul style="list-style-type: none"> Plant Manager
Alternate:	<ul style="list-style-type: none"> Reliability and Maintenance Manager Technical Services and Optimization Manager HSSE Manager Manager of Project Services, Reliability and Turnarounds.
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to EOC during Alert 2 or greater response. Alternates report to EOC to ensure position is staffed and to assist Director as requested.
Reporting:	<ul style="list-style-type: none"> Reports to the Divisional Vice President
Communications:	<ul style="list-style-type: none"> Communicates directly with Coordinators and Staff in EOC. Direct phone line to Corporate Executives via the Corporate Emergency Response Team.

DOCUMENT NO:	HSE-EAP-005	PAGE:	10 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Emergency Operations Director

- Leads and directs management support and planning efforts. Facilitates Emergency Operations groups in planning and support efforts. Approves high-level facility strategic direction plans.
- Ensures refinery or community evacuations are adequate.
- Ensures overall personnel accountability.
- Manages by objectives. Determines overall strategy for support and planning.
- Ensures security of facility.
- Establishes a planning cycle. Sets planning meeting times with Coordinators and Staff.
- May request periodic predictions on incident potential.
- Keep current on situation. Establishes information requirements and reporting schedules. Compiles emergency status summary information. Ensures agency information collection and reporting requirements are being met.
- Ensures expedition of resources requested by Emergency Response – Field Command and Manufacturing.
- Assembles information on alternative refinery operations strategies.
- Ensures that data is gathered for analysis and subsequent planning efforts.
- Ensure proper staffing of EOC and other support functions.
- Ensures investigation is initiated on event.

DOCUMENT NO:	HSE-EAP-005	PAGE:	11 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Emergency Operations Director

- Requests Legal support.
- Approves all media and employee communications releases.
- Requests activation of corporate emergency resources as necessary (Corporate Emergency Response Team CERT).
- Ensures coordination of marketing, supply and logistics as related to:
 - Customer /supplies
 - LBI affected facilities
 - Pipelines
 - Exchange partners
 - Off-site terminals
 - Railroads and truck transporters
 - Marine transporters
- Ensures recovery planning efforts are initiated as required.
- Determines and approves the demobilization of Emergency Operations resources.
- Communicates with high-level community and governmental officials as necessary.
- Communicates directly with the Divisional Vice President as required.
- Alerts Company Officials by contacting the Crisis Notification Line:

**CRISIS NOTIFICATION
281-452-8880**

Procedure for Reporting a Potential Crisis

During all hours (days and nights) call the listed number. Call immediately upon becoming aware of the reportable incident. The Channelview Complex Security Officer will answer you call.

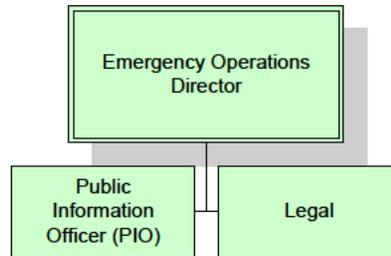
Provide:

- Your name and title
- The telephone number that you can be reached at within the next 30-minutes
- A brief description of the incident

You will be called back (normally within 15-minutes) to record all pertinent details of the incident.

DOCUMENT NO:	HSE-EAP-005	PAGE:	12 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

EMERGENCY OPERATIONS STAFF



The following are staff functions of the Emergency Operations Director.

Public Information Officer (PIO)

Public Information Officer (PIO) is responsible for interfacing with the public, media and employees. The Public Information Officer assembles accurate, accessible, and complete information on the incident. The Emergency Operations Director is responsible for approving releases of information. Corporate Public Relations may be activated as necessary to assist in accordance with the magnitude of the event.

See [Duties and Responsibilities: Public Information Officer \(PIO\)](#)

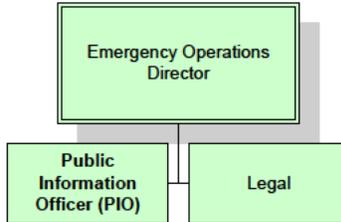
Legal

Legal provides representation and consulting support to the Emergency Operations Director. Dependent on the event, legal teams may be directed to perform legal investigations and address agency inquiries. Additionally, Legal supports Public Information, Security and Environmental Support Units.

See [Duties and Responsibilities: Legal](#)

DOCUMENT NO:	HSE-EAP-005	PAGE:	13 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

PUBLIC INFORMATION OFFICER (PIO)



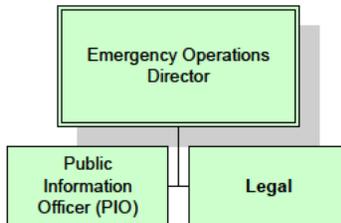
Assignment:	<ul style="list-style-type: none"> Assigned Public Affairs Manager
Alternate:	<ul style="list-style-type: none"> Alternate Public Affairs Manager Director Public Affairs (OHC)
Notification:	<ul style="list-style-type: none"> Emergency Notification System or direct call.
Response:	<ul style="list-style-type: none"> Initially reports to EOC during an Alert 2 response or greater.
Reporting:	<ul style="list-style-type: none"> Reports to Emergency Operations Director.
Communications:	<ul style="list-style-type: none"> Communicates with Emergency Operations Director by phone or by radio using EOC Channel. Communicates with Corporate Public Affairs as required.

DOCUMENT NO:	HSE-EAP-005	PAGE:	14 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Public Information Officer (PIO)
<ul style="list-style-type: none"> Initially reports to EOC and notifies Emergency Operations Director that Public Affairs are operational.
<ul style="list-style-type: none"> Records message on CAER HOTLINE (476-CAER) as necessary.
<ul style="list-style-type: none"> Ensures media and CAER Hotline information is consistent with LEPC notifications and other communications.
<ul style="list-style-type: none"> Prepares releases to media.
<ul style="list-style-type: none"> Notifies Emergency Operations Director of media inquiries and provides updates.
<ul style="list-style-type: none"> Contacts backup personnel with response instructions. Requests Corporate Public Relations support as required.
<ul style="list-style-type: none"> Ensures media releases are in time for news broadcasts and press deadlines.
<ul style="list-style-type: none"> Works with Human Resources to prepare employee information releases.
<ul style="list-style-type: none"> Confers with Human Resources to ensure messages to employees and families are consistent with media releases.
<ul style="list-style-type: none"> Notifies Main Gate Dispatch to ensure switchboard routes media inquiries properly.
<ul style="list-style-type: none"> Communicates with other refinery personnel as necessary to prepare accurate media releases.
<ul style="list-style-type: none"> Confers with Legal on preparing media releases as necessary.

DOCUMENT NO:	HSE-EAP-005	PAGE:	15 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

LEGAL

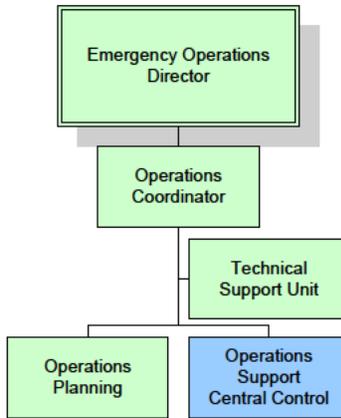


Assignment:	<ul style="list-style-type: none"> Assigned Legal representative as requested
Alternate:	<ul style="list-style-type: none"> Assigned Legal representative as requested
Notification:	<ul style="list-style-type: none"> Direct call from EOC Director
Response:	<ul style="list-style-type: none"> Reports to EOC as requested
Reporting:	<ul style="list-style-type: none"> Reports to Emergency Operations Director
Communications:	<ul style="list-style-type: none"> Reports directly to Emergency Operations Director

Duties and Responsibilities: Legal
<ul style="list-style-type: none"> Provides legal consultation on risk management or other issues.
<ul style="list-style-type: none"> Performs legal investigations as necessary.
<ul style="list-style-type: none"> Provides consultation on agency issues. Provides legal representation to site on agency inquires and investigations.
<ul style="list-style-type: none"> When activated, may review media releases before issuance.
<ul style="list-style-type: none"> Analyzes potential legal exposure from event.

DOCUMENT NO:	HSE-EAP-005	PAGE:	16 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

OPERATIONS PLANNING AND SUPPORT



Operations Planning and Support functions range from direct support of emergency response efforts to planning for mitigation and process changes.

Refinery operations are highly integrated. An emergency event may dictate process adjustments or shutdowns on upstream or downstream process units. The Operations Planning and Support group gathers data and information from the Emergency Operations – Manufacturing group in order to provide direct support, plan long term manufacturing strategies and analyze business implications.

Operations Coordinator

The Operations Coordinator provides leadership for the team's planning and support efforts in the EOC. The Coordinator will establish contact and attain information with Operations Support Unit in the Central Control Room (CCR). The Operations Coordinator will communicate this information to Operations Planning personnel located in the EOC. Circumstances at the affected unit will normally dictate the extent of support and planning actions required for the facility. Using information gathered from the event, the team develops adequate plans for future support, mitigation efforts, process changes and recovery. These plans are presented to the Emergency Operations Director.

See [Duties and Responsibilities: Operations Coordinator](#)

Technical Support Unit

Technical Support is a staff function of the Operations Coordinator. Technical Support provides technical and analytical assistance to the Operations Planning and Support group. This Technical Support position may also communicate with the Emergency Operations – Manufacturing group Technical Support personnel located in the CCRB. Accurate technical data is especially beneficial for business and mitigation planning.

See [Duties and Responsibilities: Technical Support Unit](#)

DOCUMENT NO:	HSE-EAP-005	PAGE:	17 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

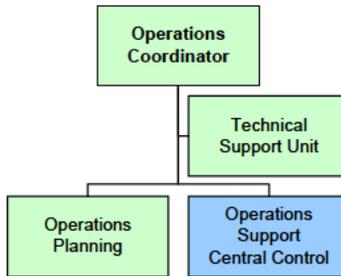
Operations Planning

Operations Planning members form a team that directly supports the emergency and develops longer term plans for support, mitigation, recovery and process changes. Developed plans are formulated considering information and data from economic/business conditions.

See [Duties and Responsibilities: Operations Planning](#)

DOCUMENT NO:	HSE-EAP-005	PAGE:	18 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

OPERATIONS COORDINATOR



Assignment:	<ul style="list-style-type: none"> Operations Superintendent, affected unit or area
Alternate:	<ul style="list-style-type: none"> Other Assigned Operations Superintendent Assigned Operations Planner
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to EOC during Alert 2 response or greater.
Reporting:	<ul style="list-style-type: none"> Reports to Emergency Operations Director
Communications:	<ul style="list-style-type: none"> Communicates by Ops - 1 radio channel or phone to Operations Support Unit in the Central Control Room (CCR). Communicates directly with Emergency Operations Director. Communicates directly with Operations Planning personnel. Communicates directly with Technical Support Unit.

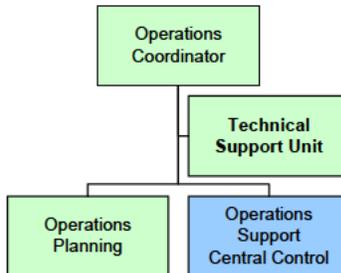
Duties and Responsibilities: Operations Coordinator	
<ul style="list-style-type: none"> Provides leadership for Operations Planning and Support. 	
<ul style="list-style-type: none"> Establishes and maintains communications with Operations Support Unit in the CCR. Attains operating unit and area status. 	
<ul style="list-style-type: none"> Maintains awareness of affected unit or area operating status. 	
<ul style="list-style-type: none"> Reports to Emergency Operations Director per required schedules. Responsible for collecting, processing and organizing operational situation information. Provides situation reports to Emergency Operations Director. Prepares operations status summary information. 	
<ul style="list-style-type: none"> Assigns Operations Planning personnel to support the emergency event as requested. Directs remaining Operations Planning personnel to planning activities. 	
<ul style="list-style-type: none"> Monitors conditions affecting the need for emergency shutdown(s). Assesses emergency situation. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	19 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Operations Coordinator
<ul style="list-style-type: none"> • Exercises responsibility for protecting product and equipment.
<ul style="list-style-type: none"> • Ensures overall accountability of operating personnel.
<ul style="list-style-type: none"> • Ensures appropriate emergency shutdown and startup procedures are initiated for refinery systems and equipment.
<ul style="list-style-type: none"> • Plans and ensures adequate staffing of respective operating units, utility areas and quality assurance during emergency conditions. Plans and coordinates operations staffing for extended events.
<ul style="list-style-type: none"> • Gathers data for analysis and subsequent planning efforts.
<ul style="list-style-type: none"> • Develops business interruption predictions, projections and forecasts.
<ul style="list-style-type: none"> • Assembles predictions on incident potential and expansion.
<ul style="list-style-type: none"> • Ensures proper direction and coordination of feed stocks and other refining product streams.
<ul style="list-style-type: none"> • Initiates recovery planning efforts with Project Services, Reliability & Turnaround organization.
<ul style="list-style-type: none"> • Ensures Operations Planning and Support staffing is adequate and available to support emergency efforts.
<ul style="list-style-type: none"> • Responsible for deactivation of other Emergency Operations Support Units, Coordinators, or personnel in their area of responsibility. Ensures proper staffing of these positions per the needs of the event.

DOCUMENT NO:	HSE-EAP-005	PAGE:	20 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

TECHNICAL SUPPORT UNIT



Assignment:	<ul style="list-style-type: none"> • Technical Superintendent, affected unit or area
Alternate:	<ul style="list-style-type: none"> • Other Assigned Technical Superintendent • Assigned Engineer
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Unit Leader reports to the EOC during Alert 2 response or greater.
Reporting:	<ul style="list-style-type: none"> • Reports to the Operations Coordinator
Communications:	<ul style="list-style-type: none"> • Communicates directly with Operations Coordinator • Communicates directly with Operations Coordinator, Operations Planning, and other EOC personnel. • Communicates directly, by phone or by Ops - 1 radio channel with Emergency Operations – Manufacturing, Technical Support and other Process Engineers.

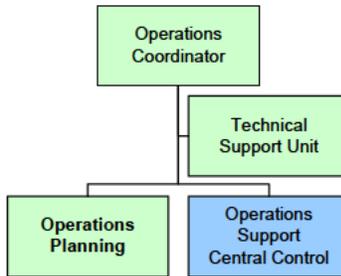
Duties and Responsibilities: Technical Support Unit	
<ul style="list-style-type: none"> • Assembles engineering staff to support emergency effort. Fulfills requests for process engineering support. Coordinates and assigns process technical support to operating units and areas. Assigns staff to various technical functions as required. 	
<ul style="list-style-type: none"> • Ensures accountability of assigned personnel. 	
<ul style="list-style-type: none"> • Participates in the development and data gathering for analysis and subsequent planning efforts. 	
<ul style="list-style-type: none"> • Ensures support of data gathering for agency reporting. 	
<ul style="list-style-type: none"> • Ensures technical support for investigations on event. 	
<ul style="list-style-type: none"> • Participates on evaluations concerning business interruption. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	21 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

- Participates in developing predictions on incident potential.
- Participates in developing alternate operations strategies.
- Works with and communicates with Technical Support Unit in the CCR to ensure proper engineering resource management.

DOCUMENT NO:	HSE-EAP-005	PAGE:	22 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

OPERATIONS PLANNING



Assignment:	<ul style="list-style-type: none"> Operations Superintendents, unaffected units or areas
Alternate:	<ul style="list-style-type: none"> Assigned Operations Planner Assigned Area Supervisor
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to EOC during Alert 2 response or greater.
Reporting:	<ul style="list-style-type: none"> Reports to Operations Coordinator
Communications:	<ul style="list-style-type: none"> Communicates directly with Emergency Operations Coordinator. Communicates directly with Technical Support as required.

Duties and Responsibilities: Operations Planning	
<ul style="list-style-type: none"> Supports the emergency event as requested by the Operations Coordinator. 	
<ul style="list-style-type: none"> Performs planning activities by collecting processing and evaluating operational situation information. Prepares operations status summary information. Provides findings to the Operations Coordinator. Reports to Emergency Operations Coordinator per required schedules. 	
<ul style="list-style-type: none"> Develops staffing plans for operating units, utility areas and quality assurance during emergency conditions. Assembles respective operations or analytical support staff necessary to assist with effort. 	
<ul style="list-style-type: none"> Gathers data for analysis and subsequent planning efforts. 	
<ul style="list-style-type: none"> Develops business interruption predictions and develops projections and forecasts of future events. Assembles predictions on incident potential. 	
<ul style="list-style-type: none"> Develops plans for direction and coordination of feed stocks and other refining product streams. 	
<ul style="list-style-type: none"> Assists with accounting for operations personnel as requested or required. 	

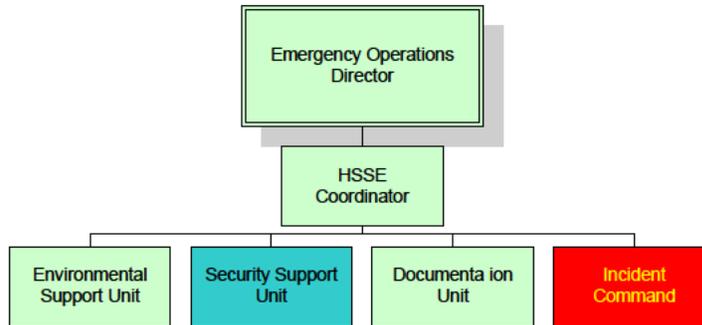
DOCUMENT NO:	HSE-EAP-005	PAGE:	23 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Operations Planning

- Supports the implementation of emergency shutdown and startup procedures are initiated for refinery systems and equipment.
- Maintains awareness of the status of unit operations in assigned area.
- Supports coordination efforts for external operation support entities, i.e., fuel, hydrogen, oxygen and water treatment services (pipeline operations).
- Supports coordination of refinery tank farm and associated pipelines in respective area or responsibility.
- Works with the Project Services, Reliability & Turnaround organization on recovery planning.
- Responsible for deactivation of other Emergency Operations Support Units, Coordinators, or personnel in their area of responsibility. Ensures proper staffing of these positions per the needs of the event.

DOCUMENT NO:	HSE-EAP-005	PAGE:	24 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

HEALTH, SAFETY, SECURITY & ENVIRONMENTAL SUPPORT



Health, Safety and Environmental (HSSE) functions range from supporting emergency response services to planning efforts relating to mitigation and recovery. HSSE support directly performs off site monitoring, agency liaison and site perimeter security.

HSSE Coordinator

The HSSE Coordinator manages and coordinates Health, Safety, Security and Environmental support functions. From the EOC, the Coordinator attains field response information from the Incident Commander. The HSSE Coordinator manages off site monitoring, ensures the security of the site perimeter and consults with supporting staff on various issues. With this information, and assessments from the field, the HSE Coordinator develops plans for adequate HSSE response and mitigation/recovery support. See [Duties and Responsibilities: HSSE Coordinator](#)

Environmental Support Unit

Environmental Support coordinates overall environmental related matters. The position monitors conditions related to the emergency that have environmental implications. Environmental Support is directly responsible for ensuring environmental reporting and off site monitoring is performed. This position is the primary liaison for environmental agencies and the U.S. Coast Guard. Environmental Support gathers information from the Environmental Officer in the Field Command Post. With this information, and assessment from the field, an environmental action plan is established. Planning may include revised agency notifications, mitigation planning, and performance of offsite monitoring.

Environmental Engineers and Specialists report to Safety Supply for agency liaison or monitoring team assignments. See [Duties and Responsibilities: Environmental Support Unit](#)

Security Support Unit

Security Support coordinates overall security related matters. The position monitors conditions related to the emergency that have facility security implications. Security Support is directly responsible for ensuring emergency resources are escorted or directed from Staging to their assignment. Security Support gathers information from the Security Coordinator in the field (emergency scene). This position also addresses outside security issues that affect the plant. Security action plans are established using the information and

DOCUMENT NO:	HSE-EAP-005	PAGE:	25 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

assessments from the field. Planning may include security resource allocation for in-plant escorts, setting up representatives for outside and in-plant roadblocks and working with law enforcement agencies to safely secure the refinery.

See [Duties and Responsibilities: Security Support Unit](#)

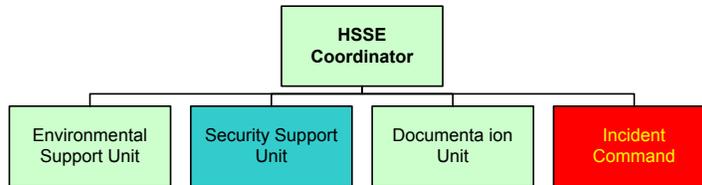
Documentation Unit

The Documentation Unit is responsible for documenting and recording all significant events related to the emergency. The Unit records field and EOC events and actions. The Documentation Unit ensures regulatory agency contacts are documented properly.

Depending on the event, supporting staff may be implemented. See [Duties and Responsibilities: Documentation Unit](#)

DOCUMENT NO:	HSE-EAP-005	PAGE:	26 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

HSSE COORDINATOR



Assignment:	<ul style="list-style-type: none"> • Manager HSSE
Alternate:	<ul style="list-style-type: none"> • H&S Manager • Environmental Manager • Emergency & Security Services Manager
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Report to EOC during Alert 2 or greater responses
Reporting:	<ul style="list-style-type: none"> • Reports to Emergency Operations Director
Communications:	<ul style="list-style-type: none"> • Communicates directly with Emergency Operations Director and other EOC members. • Communicates with Incident Command and HSE Support. All communications will be on the HSE-1 radio channel unless orders are given by Incident Command to divide traffic to other channels.

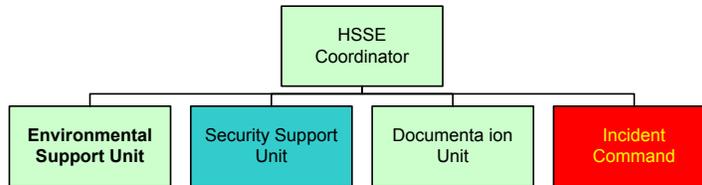
Duties and Responsibilities: HSSE Coordinator	
<ul style="list-style-type: none"> • Manages and coordinates Health, Safety, Environmental and Security support functions. Communicates with Incident Command to attain situation reports on events. Receives and reports damage and casualty reports to Emergency Operations Director. 	
<ul style="list-style-type: none"> • Establishes communications with Incident Command. 	
<ul style="list-style-type: none"> • Assists Incident Command in attaining resources for emergency response personnel. Requests resources from Logistics Support. 	
<ul style="list-style-type: none"> • May coordinate requests for outside mutual aid and response resources if requested. 	
<ul style="list-style-type: none"> • Ensures agency reporting and Community Awareness Emergency Response (CAER) Alerts are performed. Ensures LEPC notifications and communications are performed. Assumes responsibility from the Plant and Field Coordinators when EOC activated. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	27 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

<ul style="list-style-type: none"> • Directs and assigns Health and Safety personnel for OSHA liaisons and escorts. Makes certain that all environmental and law enforcement agency liaisons and escorts are in place.
<ul style="list-style-type: none"> • Ensures offsite environmental monitoring is performed.
<ul style="list-style-type: none"> • Manages and ensures that site security is maintained. Coordinates site access and entry.
<ul style="list-style-type: none"> • Advises the EOC Staff on HSSE matters. Ensures HSSE consulting is provided as necessary.
<ul style="list-style-type: none"> • Advises the EOC staff on response methods, supplies, equipment, outside support and other related matters.
<ul style="list-style-type: none"> • Ensures accountability of personnel in respective area of responsibility.
<ul style="list-style-type: none"> • Participates in developing predictions on incident potential.
<ul style="list-style-type: none"> • Prepares emergency response situation summaries and develops projections/forecasts.
<ul style="list-style-type: none"> • Initiates and coordinates internal and external investigation efforts. Ensures HSSE support for investigations. Ensures safety of investigators. Works with Incident Command to ensure scene and evidence is secure.
<ul style="list-style-type: none"> • Participates in data gathering for analysis and subsequent planning efforts.
<ul style="list-style-type: none"> • Ensures samples of spilled or released materials are obtained for analysis as emergency scene is secured (as possible).
<ul style="list-style-type: none"> • Plans and coordinates HSSE Support staffing for extended events.
<ul style="list-style-type: none"> • Coordinates risk management activities. Requests assistance from Corporate Risk Management.
<ul style="list-style-type: none"> • Communicates information to Corporate Crisis Management as required.
<ul style="list-style-type: none"> • Responsible for deactivation of other Emergency Operations Support Units, Coordinators, or personnel in their area of responsibility. Ensures proper staffing of these positions per the needs of the event.

DOCUMENT NO:	HSE-EAP-005	PAGE:	28 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

ENVIRONMENTAL SUPPORT UNIT



Assignment:	<ul style="list-style-type: none"> Environmental Manager
Alternate:	<ul style="list-style-type: none"> Consulting or Principal Environmental Engineer Assigned Environmental Engineer
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Unit Leader reports to EOC during Alert 2 or greater responses.
Reporting:	<ul style="list-style-type: none"> Reports to HSSE Coordinator.
Communications:	<ul style="list-style-type: none"> Communicates directly with the HSSE Coordinator Communicates with Environmental Officer at scene and other Environmental personnel as necessary. All communications will be on HSE-1 radio channel until orders are given by Incident Command to divide traffic.

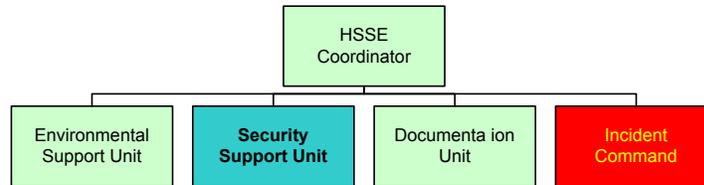
Duties and Responsibilities: Environmental Support Unit	
<ul style="list-style-type: none"> Environmental Support coordinates overall environmental related matters. Monitors conditions related to the emergency which may have environmental implications. 	
<ul style="list-style-type: none"> Communicates directly with the Environmental Officer at the emergency event to provide environmental situation reports for the HSSE Coordinator. Provides additional resources to the Environmental Officer as required. 	
<ul style="list-style-type: none"> Establishes communications with Environmental Support Unit personnel. 	
<ul style="list-style-type: none"> Ensures all environmental reporting has been performed. Coordinates and establishes contact for environmental reporting. Coordinates all follow-up reporting as necessary. Establishes and maintains communications with agencies and LEPCs. Assists in documentation of environmental reporting and other matters. 	
<ul style="list-style-type: none"> Directs all off site (community) environmental monitoring. Assigns Environmental Engineers or Specialists to Monitoring Teams. Coordinates environmental impact tracking. Reports results to HSSE Coordinator. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	29 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

- Directs and assigns Environmental personnel as liaisons for Environmental agencies to include the U.S. Coast Guard.
- Provides environmental assessment and consultation on exposure and control. Advises HSSE Coordinator on environmental matters to include proper mitigation and disposal methods.
- Manages environmental resources to provide support on and offsite. Coordinates staffing to cover extended events.

DOCUMENT NO:	HSE-EAP-005	PAGE:	30 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

SECURITY SUPPORT UNIT



Assignment:	<ul style="list-style-type: none"> Security Supervisor
Alternate:	<ul style="list-style-type: none"> Assigned HSSE Security Representative
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to Security Offices or Main Gate Dispatch Center during Alert 2 response or greater. Checks in with HSSE Coordinator.
Reporting:	<ul style="list-style-type: none"> Reports to HSSE Coordinator
Communications:	<ul style="list-style-type: none"> Communicates on the HSE-1 radio channel and by phone to HSSE Coordinator. Communicates with Security Coordinator on scene and other HSSE Security Representatives as necessary. All communications will be on HSE-1 radio channel until orders are given by Incident Command to divide traffic. May communicate with Incident Command by HSE-1 radio channel if required.

Duties and Responsibilities: Security Support Unit	
<ul style="list-style-type: none"> Security Support coordinates overall security related matters. The position monitors conditions related to the emergency that have facility security implications. 	
<ul style="list-style-type: none"> Advises and consults HSSE Coordinator on security matters. 	
<ul style="list-style-type: none"> Directs emergency response resource escorts from Staging to their assignment. 	
<ul style="list-style-type: none"> Coordinates offsite security and roadblocks. 	
<ul style="list-style-type: none"> Manages security resources to provide support on and off site. 	
<ul style="list-style-type: none"> Liaisons with law enforcement agencies for response, perimeter security and investigative efforts. 	
<ul style="list-style-type: none"> Provides security assessment and consultation on exposure and control methods. 	
<ul style="list-style-type: none"> Ensures that security reporting is performed. Updates reporting as necessary. 	

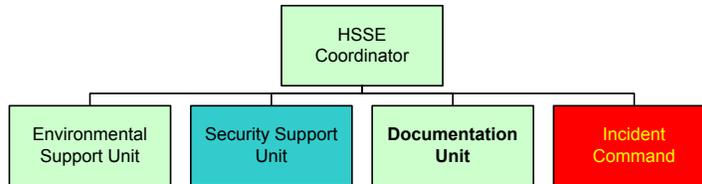
DOCUMENT NO:	HSE-EAP-005	PAGE:	31 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Security Support Unit

- Assures documentation of security reporting and other matters.
- Ensures proper closing of entry Gates per evacuation orders.
- Ensure accountability of personnel in area of responsibility.

DOCUMENT NO:	HSE-EAP-005	PAGE:	32 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

DOCUMENTATION UNIT



Assignment:	<ul style="list-style-type: none"> Assigned Environmental Engineer
Alternate:	<ul style="list-style-type: none"> Assigned Environmental Engineer
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Unit Leader responds to EOC on Alert 2 or greater events.
Reporting:	<ul style="list-style-type: none"> Reports to HSSE Coordinator
Communications:	<ul style="list-style-type: none"> Communicates with Plant Coordinator on EOC radio channel or by phone. Communicates with Field Coordinator on Operations or HSE-1 radio channel as necessary. Communicates directly with HSE Coordinator and other EOC members.

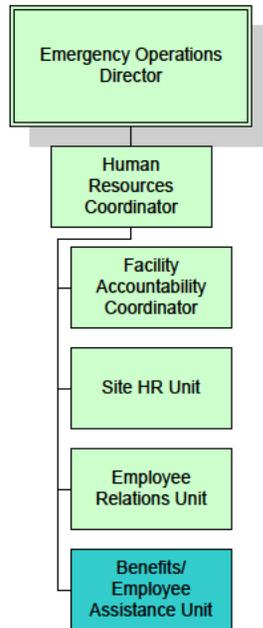
Duties and Responsibilities: Documentation Unit	
<ul style="list-style-type: none"> Documents and records all significant events related to the emergency. Initiates and documents contacts with governmental and regulatory agencies. 	
<ul style="list-style-type: none"> Controls access to EOC. Keeps unauthorized personnel out of the EOC facility. 	
<ul style="list-style-type: none"> Manages supporting staff resources. Assembles clerical support staff necessary to support effort. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	33 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Documentation Unit
<ul style="list-style-type: none">• Ensures all records are retained properly.
<ul style="list-style-type: none">• May be required to perform initial governmental and regulatory agency contact before HSSE and Environmental Support arrives.
<ul style="list-style-type: none">• May be required to issue immediate Community Awareness Emergency Response (CAER) Alerts as required.
<ul style="list-style-type: none">• Assists with tracking accountability of personnel during initial stages of an emergency.
<ul style="list-style-type: none">• Works with Legal to properly administer document releases and requests.
<ul style="list-style-type: none">• Provides emergency management organization teams with MSDS information and technical support on product and refinery streams. Obtains technical information on stock items purchased from manufacturers as necessary. May coordinate with outside technical support on identified product.

DOCUMENT NO:	HSE-EAP-005	PAGE:	34 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

HUMAN RESOURCES SUPPORT



Human Resources Support (HR) functions range from immediate employee support to planning and provision efforts relating to follow-up employee and dependent services. Functions also include community service support, risk management support and employee communications.

Roles and responsibilities of Human Resources Support may include, but not be limited to, the following areas:

- Preliminary actions
- Initial actions
- Follow-up Actions

Preliminary actions refer to planning and preparation accomplished in advance of a crisis. Preliminary actions may include preparations of lists, contact numbers, procedures, preplans and communication plans prepared in advance.

Immediate Actions are those that are necessary within the first 24-hours following an event. Follow-up actions are performed thereafter.

Human Resources members are assigned to one of the Human Resource Units. Each unit will be coordinated and supervised by a Unit Leader. Unit Leaders are responsible for ensuring all functional responsibilities of the team are met.

DOCUMENT NO:	HSE-EAP-005	PAGE:	35 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

Human Resources Coordinator

The Human Resources Coordinator manages and coordinates all Human Resource matters. The Facility Accountability Coordinator (FAC) and Human Resource Units are coordinated by the Human Resources Coordinator from the Emergency Operations Center (EOC).

The Coordinator ensures that personnel accountability and other employee information is available in the EOC. In addition, the Human Resource Coordinator works with HSSE Support on risk management activities that affect the community, employees and contractors. Coordination activities include assessing conditions of personnel affected by the event and initiating steps towards support actions. See [Duties and Responsibilities: Human Resources Coordinator](#)

Facility Accountability Coordinator

The Facility Accountability Coordinator (FAC) compiles and provides personnel accounting information on all personnel in the facility. Accountability information is gathered from Access Control System and provided to Human Resources and the Emergency Operations Director. The FAC may also assist in locating unaccounted for personnel and gathering employee information. See [Duties and Responsibilities: Facility Accountability Coordinator](#)

Site HR Unit

The Site HR Unit coordinates and conducts unplanned HR activities and provides administrative support to all Units. Additionally, the Unit may organize and coordinate condolence visits, funeral arrangements and contractor status communications. The unit also conducts other routine HR activities as requested. See [Duties and Responsibilities: Site HR Unit](#)

Employee Relations Unit

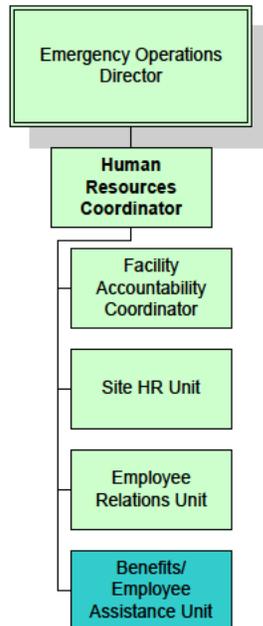
The Employee Relations Unit coordinates communications with both employees and families of injured employees. Unit members may be assigned to area hospitals in order to maintain a current status of injured employees in order to communicate this information to families. Additionally, the Unit ensures employees are informed on the status of the crisis and their role(s). See [Duties and Responsibilities: Employee Relations Unit](#)

Benefits/Employee Assistance Unit

The Benefits Unit has primary responsibility for developing and communicating benefit plan information to the HR Coordinator, other support Units, employees and family members. Additionally, the unit maintains responsibility for providing employee data. Coordinates efforts related to the Employee Assistance Program (EAP) including services for employees and families. See [Duties and Responsibilities: Benefits/Employee Assistance Unit](#)

DOCUMENT NO:	HSE-EAP-005	PAGE:	36 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

HUMAN RESOURCES COORDINATOR



Assignment:	<ul style="list-style-type: none"> • Site Human Resources Manager
Alternate:	<ul style="list-style-type: none"> • Assigned Human Resources Manager
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Reports to EOC on Alert 2 or greater
Reporting:	<ul style="list-style-type: none"> • Reports to Emergency Operations Director
Communications:	<ul style="list-style-type: none"> • Communicates directly with Emergency Operations Director and other EOC members. • Communicates with Public Affairs directly, EOC radio channel, on-line or by phone. • Communicates to other HR Support Units by means available.

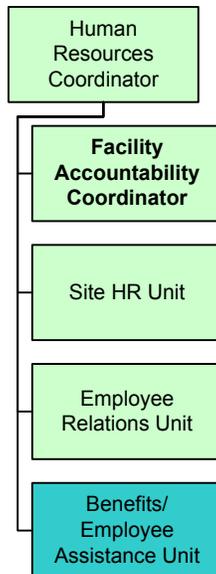
DOCUMENT NO:	HSE-EAP-005	PAGE:	37 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Human Resources Coordinator

- Manages and coordinates all Human Resource (HR) matters.
- Oversees accounting of plant personnel (evacuation accounting). Works with HSSE Coordinator on investigating whereabouts of unaccounted for personnel.
- Dispatches an Evacuation Point Coordinator with appropriate communications tools (radio, cell phone) to each evacuation point being utilized for the purpose of establishing a communication link with personnel at the Evacuation Point.
- Monitors a casualty list (effected, injured or fatality) with their conditions.
- Directs the notification of relatives of all injured or affected employees.
- Directs the activation of EAP or other psychological and emotional support for employees and family members during or following an event (employee assistance for post-traumatic or other stress management).
- Activates Corporate HR Support as required.
- Works with the Public Information Officer (PIO) to prepare emergency information and releases to employees. Ensures media and employee releases are consistent. Assist with public information releases when PIO is not available.
- Coordinates with HSSE Support on risk management activities that affect the community, employees and contractors. This includes supporting public community needs in the event of an evacuation.

DOCUMENT NO:	HSE-EAP-005	PAGE:	38 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

FACILITY ACCOUNTABILITY COORDINATOR



Assignment:	<ul style="list-style-type: none"> Health and Wellness Coordinator
Alternate:	<ul style="list-style-type: none"> Operations Clerk Assigned HR Coordinator
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to EOC during the following conditions: <ul style="list-style-type: none"> Any alert resulting in an "All Personnel" evacuation order Any alert resulting in a Plant-Wide" evacuation order Operations Clerk immediately responds to EOC and fills the Facility Accountability Coordinator (FAC) role.
Reporting:	<ul style="list-style-type: none"> Reports to Human Resources Coordinator
Communications:	<ul style="list-style-type: none"> Communicates directly with Human Resources Coordinator and other Coordinators as necessary. Communicates with field reports by secured accountability phone line and Ops-1 Radio Channel.

DOCUMENT NO:	HSE-EAP-005	PAGE:	39 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Facility Accountability Coordinator (FAC)

- Compiles and provides personnel accounting information on all personnel in the facility. Documents and tracks personnel accountability efforts. Provides and updates employee data to support accountability efforts.
- Works with other support groups to locate unaccounted for personnel and gather employee information.
- Reports accountability information to Human Resources Coordinator and Emergency Operations Director.

DOCUMENT NO:	HSE-EAP-005	PAGE:	40 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

SITE HR UNIT



Assignment:	<ul style="list-style-type: none"> Assigned HRO HR Coordinator
Alternate:	<ul style="list-style-type: none"> Assigned HRO HR Coordinator
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Unit Leader reports to EOC on Alert 2 or greater events. May begin some functions outside of facility before response. Additional Unit members activated by Leader as required. Unit members meet with Human Resources Office Area.
Reporting:	<ul style="list-style-type: none"> Reports to the Human Resources Coordinator
Communications:	<ul style="list-style-type: none"> Communicates with HR Coordinator by means available. Communicates to other Human Resource Support personnel by means available.

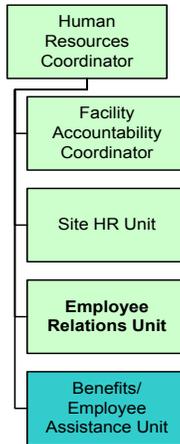
Duties and Responsibilities: Site HR Unit	
<ul style="list-style-type: none"> Maintains a casualty list (effected, injured or fatality) with relevant information to include: condition, treatment and location i.e., on site or hospital. 	
<ul style="list-style-type: none"> Provides personnel information to EOC as needed. 	
<ul style="list-style-type: none"> Coordinates and conducts unplanned Human Resources (HR) activities and provides administrative support to all Units. 	
<ul style="list-style-type: none"> The unit also conducts other routine HR activities as requested. 	
<ul style="list-style-type: none"> Documents actions taken. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	41 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Human Resources Support
Duties and Responsibilities: Site HR Unit
INITIAL ACTIONS
<ul style="list-style-type: none"> Establishes and maintains communications with Human Resources Coordinator. Notifies Coordinator when on site.
<ul style="list-style-type: none"> Primary responsibility for Community Awareness Emergency Response Line Alerts (CAER Line Messages). Works with Public Information Officer (PIO) and HSSE Coordinator as necessary to ensure consistency of messages.
<ul style="list-style-type: none"> Establishes and maintains communication with contractors and/or services contact persons concerning the status of their personnel.
<ul style="list-style-type: none"> Interfaces with the Supply Unit (Purchasing Representative) as required.
FOLLOW-UP ACTIONS
<ul style="list-style-type: none"> Organizes and coordinates funeral and condolence visits by senior management personnel.

DOCUMENT NO:	HSE-EAP-005	PAGE:	42 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

EMPLOYEE RELATIONS UNIT



Assignment:	<ul style="list-style-type: none"> Assigned Human Resources Manager
Alternate:	<ul style="list-style-type: none"> Assigned HRO Human Resources Coordinator
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Unit Leader reports to EOC when activated by the Human Resources Coordinator. Additional Unit members activated by Leader as required. Members meet in Human Resources Office Area.
Reporting:	<ul style="list-style-type: none"> Reports to Human Resources Coordinator
Communications:	<ul style="list-style-type: none"> Communicates with Human Resources Coordinator by means available. Communicates to other Human Resources Support personnel by means available.

DOCUMENT NO:	HSE-EAP-005	PAGE:	43 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Employee Relations Unit
<ul style="list-style-type: none"> As directed by the Human Resources Coordinator, coordinates communications with both employees and families of injured employees. Ensures employees are informed on the status of the crisis and their role(s).
<ul style="list-style-type: none"> As directed by the Human Resources Coordinator, activates Corporate HR Support and/or Benefits/Employee Assistance Unit support.
<ul style="list-style-type: none"> Assigns Unit members to area hospitals in order to maintain a current status of injured employees in order to communicate this information to families.
<ul style="list-style-type: none"> Documents actions taken.
INITIAL ACTIONS
<ul style="list-style-type: none"> Establishes and maintains communication and liaison with Public Information Officer (PIO).
<ul style="list-style-type: none"> Establishes and maintains log of injured employee name, location of hospital, and current status of condition.
<ul style="list-style-type: none"> Contacts family members of injured/deceased employee(s) to advise them of situation and location of hospital to which the employee has been sent. Maintain a log of relevant information.
<ul style="list-style-type: none"> Assembles and dispatches HR staff to hospitals where injured employees have been transported.
<ul style="list-style-type: none"> Maintains communication with HR staff assigned to hospitals for updates on and status of injured and/or deceased. Keeps the Human Resources Coordinator up to date.
<ul style="list-style-type: none"> Provides hospital liaisons with appropriate benefits information from Benefits/Employee Assistance Unit.
<ul style="list-style-type: none"> Evaluates staff requirements and assembles staff members required to provide communications with families.
<ul style="list-style-type: none"> Prepares and maintains a list of all Human Resources (HR) staff members, to provide to security and police during an emergency, in order to effectively gain access to the site.
<ul style="list-style-type: none"> Establishes provisions for handling incoming calls from families.
<ul style="list-style-type: none"> Unit members maintain log of family and employee communications.

DOCUMENT NO:	HSE-EAP-005	PAGE:	44 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Employee Relations Unit

- | |
|---|
| <ul style="list-style-type: none"> • Coordinates with Public Information Officer (PIO) to use media sources to communicate special instructions to employees and family members. |
| <ul style="list-style-type: none"> • Maintains communications with union leadership. |

FOLLOW-UP ACTIONS

- | |
|---|
| <ul style="list-style-type: none"> • Establishes and maintains "hot line(s)" for family members to call to address concerns. |
| <ul style="list-style-type: none"> • Organizes Unit members to ensure required coverage for extended events. |
| <ul style="list-style-type: none"> • Communicates names of injured/deceased employees and family members' names (if known) to Employee Assistance Unit and Benefits Unit Leaders |

DOCUMENT NO:	HSE-EAP-005	PAGE:	45 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

BENEFITS / EMPLOYEE ASSISTANCE UNIT



Assignment:	<ul style="list-style-type: none"> • Benefits Consultant
Alternate:	<ul style="list-style-type: none"> • Assigned Corporate Benefits Representative
Notification:	<ul style="list-style-type: none"> • Notified by Human Resources Coordinator (cell phone)
Response:	<ul style="list-style-type: none"> • Unit Leader reports to Human Resources office when activated by the Human Resources Coordinator. Additional Unit members activated by Leader as required.
Reporting:	<ul style="list-style-type: none"> • Reports to Human Resources Coordinator
Communications:	<ul style="list-style-type: none"> • Communicates with Human Resources Coordinator by means available. • Communicates to other Human Resources Support personnel by means available.

Duties and Responsibilities: Benefits / Employee Assistance Unit	
<ul style="list-style-type: none"> • Primary responsibility for developing and communicating benefit plan information to the Human Resources Coordinator, other support Units, employees and family members. 	
<ul style="list-style-type: none"> • Coordinates Employee Assistance Program (EAP) services for employees and families. 	
<ul style="list-style-type: none"> • Responsibility for providing employee data as necessary. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	46 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Benefits / Employee Assistance Unit
PRELIMINARY ACTIONS
<ul style="list-style-type: none"> • Prepares and maintain a list of all benefit vendors to contact in an emergency for the provision of information.
<ul style="list-style-type: none"> • Prepares and maintain a list of all hospitals in the area and the nearest hotels. Establish vendor numbers and procurement requirements for charging hotel services.
<ul style="list-style-type: none"> • Arranges with accounting, procedures for the immediate accessing of petty cash for Human Resources and family needs during an emergency condition.
<ul style="list-style-type: none"> • Organizes and establishes Benefit/Employee Data Teams as needed (insurance plan vendors, carriers, etc.). Assist with the coordination of Workers Compensation issues.
INITIAL ACTIONS
<ul style="list-style-type: none"> • Evaluate and determine the extent of the emergency from a benefits/employee data perspective.
<ul style="list-style-type: none"> • Develop, communicate and distribute a benefit plan to the HR Unit Leaders.
<ul style="list-style-type: none"> • Establish an on-site office, with systems access. Prepare reports as requested by HR Unit Leaders.
<ul style="list-style-type: none"> • Maintain contact with Human Resource Coordinator for information on injured and/or deceased employees.
<ul style="list-style-type: none"> • Prepare reports on effected (injured and/or deceased) employees to be used internally. Reports may include but not be limited to: information on hire date, birth date, emergency contact, emergency contact phone number, relationship, beneficiary data, address, home phone and other pertinent telephone numbers. These types of reports will be used when discussing information with family member. <i>All information regarding employee benefits and salary must be held to a high level of confidentiality. Information may only be discussed with the emergency contact or listed beneficiaries.</i>
<ul style="list-style-type: none"> • Ensure availability of EAP resources and acts as liaison. <ul style="list-style-type: none"> • Arranges on-site EAP support as required. • Assists with personal needs of the EOC and other emergency personnel. • Documents all EAP referrals (employees and families) and follow up as needed.

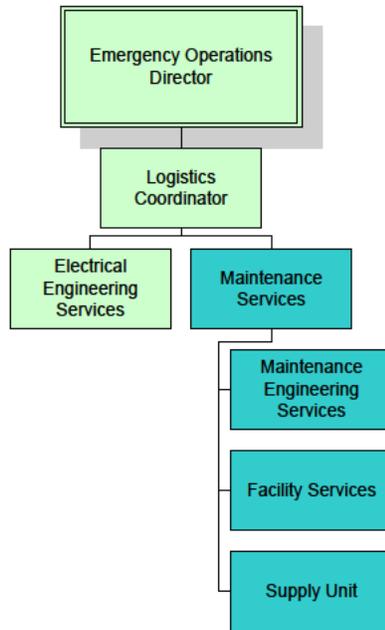
DOCUMENT NO:	HSE-EAP-005	PAGE:	47 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

FOLLOW-UP ACTIONS

- Establish and assemble Benefit/Employee Data teams to provide 24-hr or extended coverage as necessary.
- Contact and assemble vendor and account representative to expedite claims processing.
- Discuss with Legal Department, benefit and worker's compensation issues in advance of meetings with employee family members or beneficiaries.
- Establish and maintain a "Benefits Hot-line" to provide employee information and to afford a means to make inquiries.
- Determine and recommend to the Human Resources Coordinator "special" benefit needs for employees and families.
- Work with other members of the Human Resources unit to assist employee family members with travel arrangements as necessary.
- Designate time and place for family members to meet for discussion of benefits.
- Advise Human Resources Coordinator on compensation/benefit issues.
- Determine if visits to families are necessary relating to benefits.
- Monitors EAP activities and follow up as necessary.

DOCUMENT NO:	HSE-EAP-005	PAGE:	48 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

LOGISTICS SUPPORT



Logistics Support provides the facility supplies and maintenance support during emergency conditions. Logistics Support provides immediate services to refinery operations and Emergency Response Teams. The team also plans mitigation support for cleanup and repair activities.

Logistics Coordinator

The Logistics Coordinator manages and coordinates all supply and maintenance support activities during emergency situations. Field service and supply requests will be routed to the Logistics Coordinator in EOC. From EOC, the Logistics Coordinator will expedite supplies and services through Logistics Support teams. As Operations Coordinators plan for mitigation and repairs, the Logistics Coordinator will dispatch the appropriate resources to support the strategy. See [Duties and Responsibilities: Logistics Coordinator](#)

Electrical Engineering Services

Electrical Engineering Services provides communications, instrumentation and electrical support for the facility. The service team provides engineering resources and directs maintenance to communications, instrument and electrical equipment. Electrical Engineering Services is responsible for ensuring facility radio communications equipment is operating properly. See [Duties and Responsibilities: Electrical Engineering Services](#)

DOCUMENT NO:	HSE-EAP-005	PAGE:	49 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

Maintenance Services

Maintenance Services supervises and directs personnel and equipment as required to support maintenance activities for response and mitigation.

Maintenance Services receives requests from the Logistics Coordinator in EOC, and dispatches assignments tasks to service and engineering groups. See [Duties and Responsibilities: Maintenance Services](#)

Maintenance Engineering Services

Maintenance Engineering provides engineering and inspection support for the facility. The team may be requested to perform field evaluations of damaged equipment to determine integrity. See [Duties and Responsibilities: Maintenance Engineering Services](#)

Facility Services

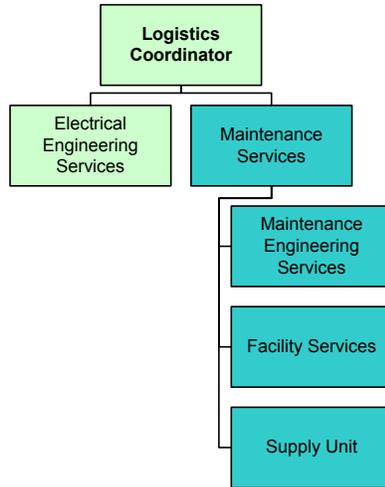
Facility Services provides facility service resources and equipment during emergencies and sets up support services ranging from food provisions to housing. See [Duties and Responsibilities: Facility Services](#)

Supply Unit

The Supply Unit provides procurement services for the facility during an emergency. The Unit Leader procures any equipment and supplies necessary for response and mitigation efforts. See [Duties and Responsibilities: Supply Unit](#)

DOCUMENT NO:	HSE-EAP-005	PAGE:	50 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

LOGISTICS COORDINATOR



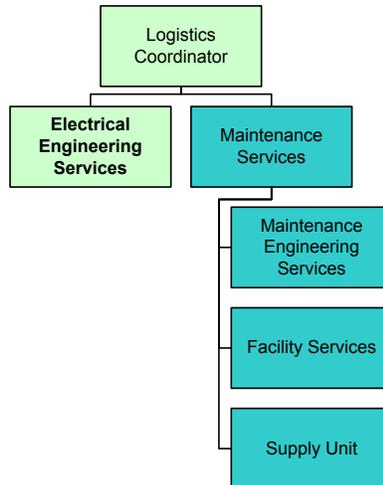
Assignment:	<ul style="list-style-type: none"> Maintenance Superintendent On-Call
Alternate:	<ul style="list-style-type: none"> Assigned Maintenance Superintendent Assigned Coordinator or Supervisor
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to EOC during Alert 2 response or greater
Reporting:	<ul style="list-style-type: none"> Reports to Emergency Operations Director
Communications:	<ul style="list-style-type: none"> Communicates with Emergency Operations Director and other EOC members directly. Communicates with Electrical Engineering Services directly. Communicates with Maintenance Services on Maint. - 1A radio channel or by phone.

DOCUMENT NO:	HSE-EAP-005	PAGE:	51 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Logistics Coordinator
<ul style="list-style-type: none"> Manages and coordinates all supply and maintenance support activities during emergency situations. From EOC, the Logistics Coordinator will expedite supplies and services through Logistics Support teams.
<ul style="list-style-type: none"> Plan for mitigation and repairs as required to support the operational and emergency strategy.
<ul style="list-style-type: none"> Ensures the EOC, Field Command Posts and other emergency facilities and equipment are serviced.
<ul style="list-style-type: none"> Coordinates the supply of support services and resources to EOC, Emergency Response and Operations.
<ul style="list-style-type: none"> Maintains location of all maintenance and maintenance engineering personnel for the duration of the emergency incident.
<ul style="list-style-type: none"> Directs repairs of plant equipment that are immediately necessary per the strategic and tactical priority.
<ul style="list-style-type: none"> Provides facilities, transportation, supplies, equipment, maintenance, fueling, food services, and communications.
<ul style="list-style-type: none"> Ensures accountability of all maintenance contract personnel.
<ul style="list-style-type: none"> Maintains required maintenance coverage for duration of the emergency.
<ul style="list-style-type: none"> Arranges for ordering resources for off-site locations.
<ul style="list-style-type: none"> Ensures adequate provision of communications equipment for event.
<ul style="list-style-type: none"> Works with the Project Services, Reliability & Turnaround organization on recovery planning.

DOCUMENT NO:	HSE-EAP-005	PAGE:	52 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

ELECTRICAL ENGINEERING SERVICES



Assignment:	<ul style="list-style-type: none"> IEA Reliability Superintendent
Alternate:	<ul style="list-style-type: none"> Assigned Engineer Assigned Specialist
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to EOC during Alert 2 or greater response
Reporting:	<ul style="list-style-type: none"> Reports to Logistics Coordinator
Communications:	<ul style="list-style-type: none"> Communicates with Logistics Coordinator directly Communicates with personnel on Maint. -1A radio channel.

Duties and Responsibilities: Electrical Engineering Services	
<ul style="list-style-type: none"> Provides communications, instrumentation and electrical support for the facility. The service team provides engineering resources and directs maintenance to communications, instrument and electrical equipment. 	
<ul style="list-style-type: none"> Electrical Engineering Services is responsible for ensuring facility radio communications equipment is operating properly. Ensures that in-plant communications equipment remains operative. 	
<ul style="list-style-type: none"> Dispatches appropriate instrument and electrical maintenance and engineering personnel and equipment to where their services are required during an emergency. 	

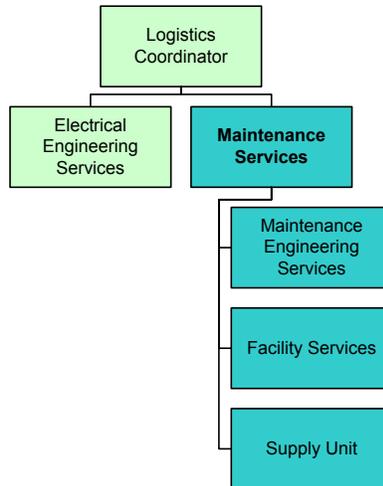
DOCUMENT NO:	HSE-EAP-005	PAGE:	53 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Electrical Engineering Services

- Assembles Instrument, Electrical and Radio Service staff as necessary to support emergency effort. Maintains required maintenance coverage for duration of the emergency. Contacts and makes arrangements for additional communications, instrumentation and electrical support personnel as directed by the Logistics Coordinator. Maintains data on the location of all electrical and instrumentation maintenance personnel for the duration of the emergency incident.
- Ensures accountability of personnel in respective areas.
- Assumes responsibility for facility electrical utilities.
- Ensures that scheduled preventative maintenance is performed on all equipment in the EOC, the Main Gate Dispatch Center and the Command Van (Field Command Post).
- Arranges for repair and other support services to plant mobile radio equipment.
- Arranges for procurement of backup radio systems equipment as necessary.

DOCUMENT NO:	HSE-EAP-005	PAGE:	54 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

MAINTENANCE SERVICES



Assignment:	<ul style="list-style-type: none"> Central Maintenance Superintendent
Alternate:	<ul style="list-style-type: none"> Assigned Coordinator Assigned Supervisor
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to East Wing Conference Room B on an Alert 2 or greater event.
Reporting:	<ul style="list-style-type: none"> Reports to Logistics Coordinator
Communications:	<ul style="list-style-type: none"> Communicates with Logistics Coordinator by Maint. - 1A radio channel or by phone.

Duties and Responsibilities: Maintenance Services	
<ul style="list-style-type: none"> Maintenance Services supervises and directs personnel and equipment as required to support maintenance activities for response and mitigation. Dispatches appropriate maintenance, facilities and maintenance engineering personnel and equipment to the emergency scene and associated affected units. 	
<ul style="list-style-type: none"> Services EOC, Field Command Posts and other emergency facilities and equipment. 	
<ul style="list-style-type: none"> Ensures accountability of personnel in respective area. 	
<ul style="list-style-type: none"> Provides back-up coverage for Machinery/Maintenance. Services. 	
<ul style="list-style-type: none"> Assembles and assigns Maintenance staff as necessary to support emergency effort. 	
<ul style="list-style-type: none"> Plans and coordinates maintenance activities for future response and mitigation efforts. 	

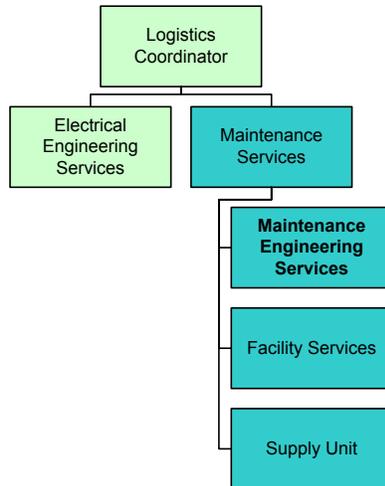
DOCUMENT NO:	HSE-EAP-005	PAGE:	55 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Maintenance Services

- Directs facilities, transportation, supplies, equipment, maintenance, fueling, food services, and communications.
- Provides facilities, transportation, supplies, equipment, maintenance, fueling and communications services.

DOCUMENT NO:	HSE-EAP-005	PAGE:	56 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

MAINTENANCE ENGINEERING SERVICES



Assignment:	<ul style="list-style-type: none"> Assigned Fixed Equipment Reliability or Machinery Superintendent
Alternate:	<ul style="list-style-type: none"> Assigned Supervisor Assigned Engineer Assigned Specialist
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to East Wing Conference Room B when requested by Maintenance Services.
Reporting:	<ul style="list-style-type: none"> Reports to Maintenance Services
Communications:	<ul style="list-style-type: none"> Communicates directly with Maintenance Services Communicates with personnel on Maint. -1A radio channel or by phone.

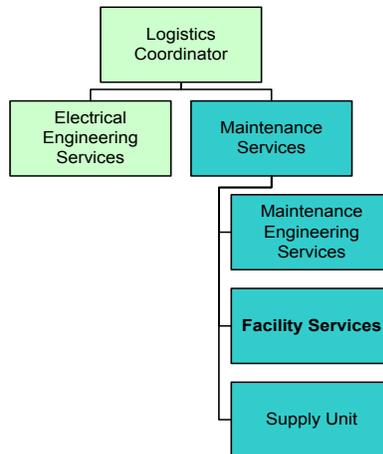
DOCUMENT NO:	HSE-EAP-005	PAGE:	57 OF 60
DOCUMENT NAME: EMERGENCY OPERATIONS ORGANIZATION			

Duties and Responsibilities: Maintenance Engineering Services

- Provides engineering and inspection support for the facility. The team may be requested to perform field evaluations of damaged equipment to determine integrity.
- Dispatches appropriate engineering and inspection personnel and equipment to emergency scene and associated affected units.
- Assembles staff as necessary to support emergency effort. Maintains data on the location of all engineering and inspection personnel for the duration of the emergency incident.
- Ensures accountability of personnel in respective areas.
- Provides damage assessments as requested.
- Provides field structural and equipment surveys to determine integrity.

DOCUMENT NO:	HSE-EAP-005	PAGE:	58 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

FACILITY SERVICES

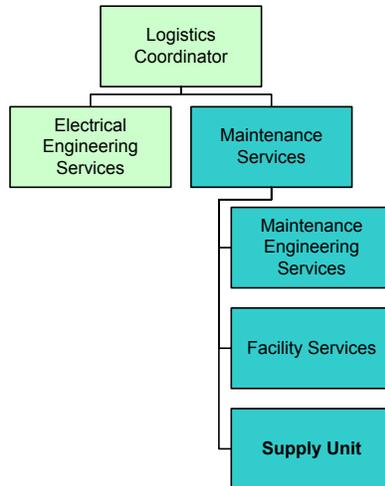


Assignment:	<ul style="list-style-type: none"> Facility Coordinator
Alternate:	<ul style="list-style-type: none"> Assigned Coordinator Assigned Supervisor
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to East Wing Conference Room B on Alert 2 or greater response.
Reporting:	<ul style="list-style-type: none"> Reports to Maintenance Services
Communications:	<ul style="list-style-type: none"> Communicates with Maintenance Services directly Communicates with respective contract crews on Maint.-1A or by phone.

Duties and Responsibilities: Facility Coordinator	
<ul style="list-style-type: none"> Provides facility service resources and equipment during emergencies and sets up support services ranging from food provisions to housing. 	
<ul style="list-style-type: none"> Ensures accountability of personnel in respective area. 	
<ul style="list-style-type: none"> Supplies EOC and Emergency Response Teams with provisions (food, drinks, clothing, etc.). Interfaces with purchasing as necessary. 	
<ul style="list-style-type: none"> Assists security with site and scene security. Supplies barricades and roadway blocking materials and supplies. 	
<ul style="list-style-type: none"> Assembles staff as necessary to support emergency effort. 	
<ul style="list-style-type: none"> Provides temporary trailer or housing for personnel residency and agencies. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	59 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

SUPPLY UNIT



Assignment:	<ul style="list-style-type: none"> On-Call Procurement and Materials Representative
Alternate:	<ul style="list-style-type: none"> Assigned Procurement representative
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Unit Leader reports to East Wing Conference Room B when requested by Maintenance Services.
Reporting:	<ul style="list-style-type: none"> Reports to Maintenance Services
Communications:	<ul style="list-style-type: none"> Communicates with Maintenance Services directly or by phone. Communicates with outside vendors as required.

Duties and Responsibilities: Supply Unit	
<ul style="list-style-type: none"> Provides procurement services for the facility during an emergency. The Unit Leader procures any equipment and supplies necessary for response and mitigation efforts. 	
<ul style="list-style-type: none"> Procures necessary equipment, material, and supply resources for the emergency and other facility needs. 	
<ul style="list-style-type: none"> Ensures warehouse personnel are available to issue supplies. 	
<ul style="list-style-type: none"> Assembles on site or Corporate Purchasing and Procurement staff as necessary to support emergency. 	

DOCUMENT NO:	HSE-EAP-005	PAGE:	60 OF 60
DOCUMENT NAME:			
EMERGENCY OPERATIONS ORGANIZATION			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-006	Page: 1 OF 26	Approval Date:	06/30/2011
Document Title:	EMERGENCY OPERATIONS - MANUFACTURING				
Approver: CHRIS MATTHEWS	<i>Electronic Signature on File</i>			Effective Date:	07/01/2011
Document Owner: Jeff Windham	<i>Electronic Signature on File</i>			Review Date:	02/24/2011

TABLE OF CONTENTS

Summary	2
Scope and References	2
Definitions	2
Roles and Responsibilities	3
Flowchart	7
Procedure	8
Operations Support Unit	8
Plant Coordinator	10
Technical Support Unit	13
Console Support Unit	15
Console Operator	18
Field Coordinator	20
Field Support Unit	22
Chief Operator	25
 Revision Summary	 27

DOCUMENT NO:	HSE-EAP-006	PAGE:	2 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

SUMMARY

The Emergency Operations - Manufacturing group provides direct process operations control of the involved process units, areas and other refinery operations. The group manages strategic efforts relating to affected unit operations, emergency shutdowns and emergency response.

Emergency Operations – Manufacturing is composed of Operations management/supervision and operations personnel in Central Control and in the field.

SCOPE AND REFERENCES

ACTIVATION

Portions of the Emergency Operations – Manufacturing group are activated during all Alerts affecting process units or areas. The entire group is activated during an Alert 2 or greater event.

Other Emergency Operations Activations

For refinery events or incidents that may not demand an Alert activation, to include, but may not be limited too, security events, bomb threats, or serious operational upsets, Emergency Operations, may be activated by the Plant Shift Superintendent, a Plant Manager, or Manager/Superintendent.

Reporting Locations

The Emergency Operations – Manufacturing group reports to the Central Control Room or directly to the affected and unaffected process units or areas.

Check In

On arrival to their reporting location, responders shall check in as per their reporting assignment. Check in includes establishing communications per job duties and responsibilities.

DEFINITIONS

Affected Unit or Area - A process manufacturing unit, terminal, or loading facility that is experiencing an emergency event (fire, spill, and gas release).

Central Control or Central Control Room (CCR) – The physical location in which process operations consoles are located for controlling and monitoring of manufacturing operations activities. The refinery operates processes from a central control location.

Chief Operator – For the purpose of this EAP section, the “Chief Operator” is defined as the process unit assigned Chief, Oil Movements Pumper and lead or #1 marine terminal Dockman.

DOCUMENT NO:	HSE-EAP-006	PAGE:	3 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Emergency Operations Center (EOC) – The physical location at which the coordination of information and resources to support incident management (on-scene) and planning activities takes place.

Field Command Post (FCP) or Incident Command Post – The field location where the primary functions of incident management are performed. The FCP may be located in a command support vehicle or mobile command van.

Process Unit or Area - For the purpose of the EAP, a “process unit or area” is defined as any operations functional area to include manufacturing, terminals, loading facilities, and utility units.

Unaffected Unit or Area – A process manufacturing unit, terminal or loading facility that is not directly affected by an emergency in the facility but may be required to perform operational adjustments and changes.

ROLES AND RESPONSIBILITIES

Operations Support Unit

The Operations Support Unit directly supports manufacturing emergency response efforts. When activated, the Unit Leader assists the Plant Coordinator with short-term and long term process adjustments, diagnostics and shut down options. This Operations Support function communicates situation reports directly to the Operations Coordinator in the Emergency Operations Center (EOC). See [Duties and Responsibilities: Operations Support Unit](#)

Plant Coordinator

From the Central Control Room, the Plant Shift Superintendent assumes the position of Plant Coordinator. The Plant Coordinator provides direction and management relating to refinery manufacturing emergency operations and response. The Plant Coordinator directs implementation of operational strategies into tactical actions aimed at minimizing impact to the refinery.

The Plant Coordinator exercises supervisory control over the operating consoles. The Plant Coordinator communicates directly with the Field Coordinator, at the Field Command Post (FCP), during Alert 1 events, and with Console Support Units (in the CCR) during Alert 2 or greater events. See [Duties and Responsibilities: Plant Coordinator](#)

DOCUMENT NO:	HSE-EAP-006	PAGE:	4 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

The Plant Coordinator interacts with Console Operators to facilitate and ensure that:

- Appropriate emergency systems are activated in the affected unit or area.
- Unit personnel are accounted for.
- Appropriate shutdown measures are taken.
- Process adjustments are made to minimize the effects of the emergency in both affected and non-affected areas.
- Actions are coordinated and communicated through the Field Coordinator and Incident Command.

Spill Response

The Plant Coordinator is considered the primary Spill Response “Qualified Individual (QI).” See *Spill Response and Prevention Plan, SRPP*.

Technical Support Unit

Technical Support is a staff function of the Plant Coordinator. Technical Support provides process technical and analytical assistance directly to manufacturing groups in the Central Control Room. This Technical Support position may also be communicating with the Technical Support Unit personnel located in the EOC. See [Duties and Responsibilities: Technical Support Unit](#)

Console Support Unit

When activated, the Console Support Unit assists the Console Operator in their efforts to adjust processes and shut down equipment in accordance with emergency operating procedures. The Unit Leader assists the Console with communications to other operations personnel or outside/external groups, i.e. fuel, hydrogen, oxygen, power, water treatment and pipeline operations. The Support Unit also interacts and gathers operations situation reports from Console Operators, Field Support Units and the Field Coordinator. These reports are provided to assist the Plant Coordinator in future planning efforts. See [Duties and Responsibilities: Console Support Unit](#)

Console Operator

The Console Operators of both affected and non-affected process units evaluate the impact of the emergency on their respective process units/areas. Following this evaluation, the Console Operator may begin shutting down equipment or making process adjustments in accordance with emergency or other operating procedures. Console Operators maintain contact with the Chief Operator on strategic and tactical issues. The Console Operators communicate directly with the Plant Coordinator or when activated with their respective Console Support Unit Leader. See [Duties and Responsibilities: Console Operator](#)

The Console Operator must:

- Gather personnel accountability reports from the Chief Operator and pass them on to the Plant Coordinator or Console Support Unit when activated.
- Coordinate with Chief Operators, the Plant Coordinator and Console Support Unit respectively to make appropriate process adjustments.

DOCUMENT NO:	HSE-EAP-006	PAGE:	5 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Field Coordinator

The assigned Operations Field Support Unit assumes the position of Field Coordinator. The Field Coordinator is the primary liaison between process unit operations and the Emergency Response Group. Communication between these groups is critical to ensure a safe and effective response.

The Field Coordinator is unified with Incident Command in the Field Command Post (FCP).

The Field Coordinator establishes and maintains contact with the Field Support Unit Leader of the affected process unit or area. This contact will enable strategic plans to be established for overall emergency and hazard control.

The Field Coordinator will also establish and maintain contact with the Plant Coordinator in the Central Control Room. Additionally, the Field Coordinator may be requested to provide direct updates to the Operations Coordinator in EOC. This contact may be established to keep EOC apprised of field conditions, strategies, and actions being taken to control the emergency. The Operations Coordinator uses this information to plan field support efforts, refinery wide operations, mitigation plans, and business strategies. [See *Duties and Responsibilities: Field Coordinator*](#)

Field Support Unit

Field Support Units report to the field (unit or process area) and supervise plant-operating functions in their respective areas. A Field Support Unit is comprised of a Leader and other assigned support personnel.

The Field Support Unit Leader ensures personnel accountability and provides information to the Field Coordinator or Console Support Units as expediently as possible.

Field Support Units interact with Chief Operators as required to gather appropriate information to facilitate the initiation of emergency actions and associated process changes. Field Support Unit Leaders communicate with their respective Console Support Units, or if their unit is affected, with the Field Coordinator to provide necessary information for support and response planning efforts.

The Field Support Unit will remain on assignment assisting the Chief Operator in coordination of tactical efforts. Communication will be established and maintained with the Field Coordinator on the Ops-1 radio channel or with the Console Support Unit on the assigned operations radio channel.

The Field Support Unit Leader may also serve as liaison with Emergency Response - Operations personnel in setting up tactical teams of operators and emergency response personnel. See [Duties and Responsibilities: Field Support Unit](#)

DOCUMENT NO:	HSE-EAP-006	PAGE:	6 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Chief Operator

For the purposes of the EAP, the “Chief Operator” is defined as the operator of any manufacturing, terminal, loading, or utility facility functioning at the highest position in a line of authority or progression.

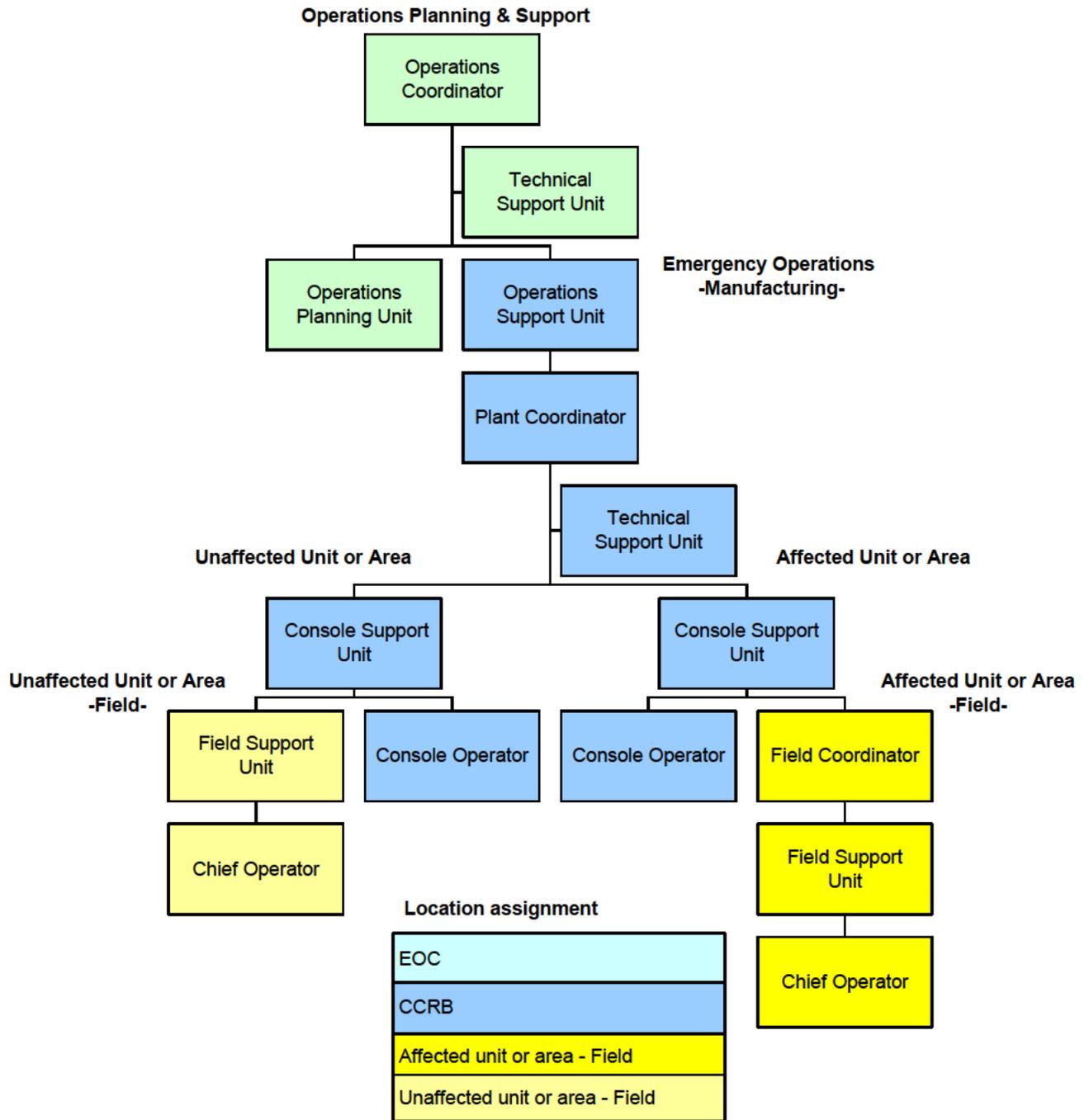
The Chief Operator, of the affected process unit, will direct and implement operations response efforts and emergency shutdowns. The Chief Operator maintains communications with the Console Operator. The Chief Operator will maintain contact with the Field Support Unit on strategic matters. See [Duties and Responsibilities: Chief Operator](#)

The affected unit Chief Operator gathers and maintains accountability of all unit operators. This information is reported to the Console Operator and Incident Command. The Chief Operator must:

- Ensure that the Main Gate Dispatcher is notified of the emergency.
- Ensure that fixed manual or automatic fire protection systems and other safety systems are activated.
- Gather reports on personnel accountability and pass them on to the Console Operator and directly to Incident Command or the Field Coordinator if their unit is affected.
- Work with the Console Operator to direct unit personnel conducting operations response and shutdown efforts.

DOCUMENT NO:	HSE-EAP-006	PAGE:	7 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

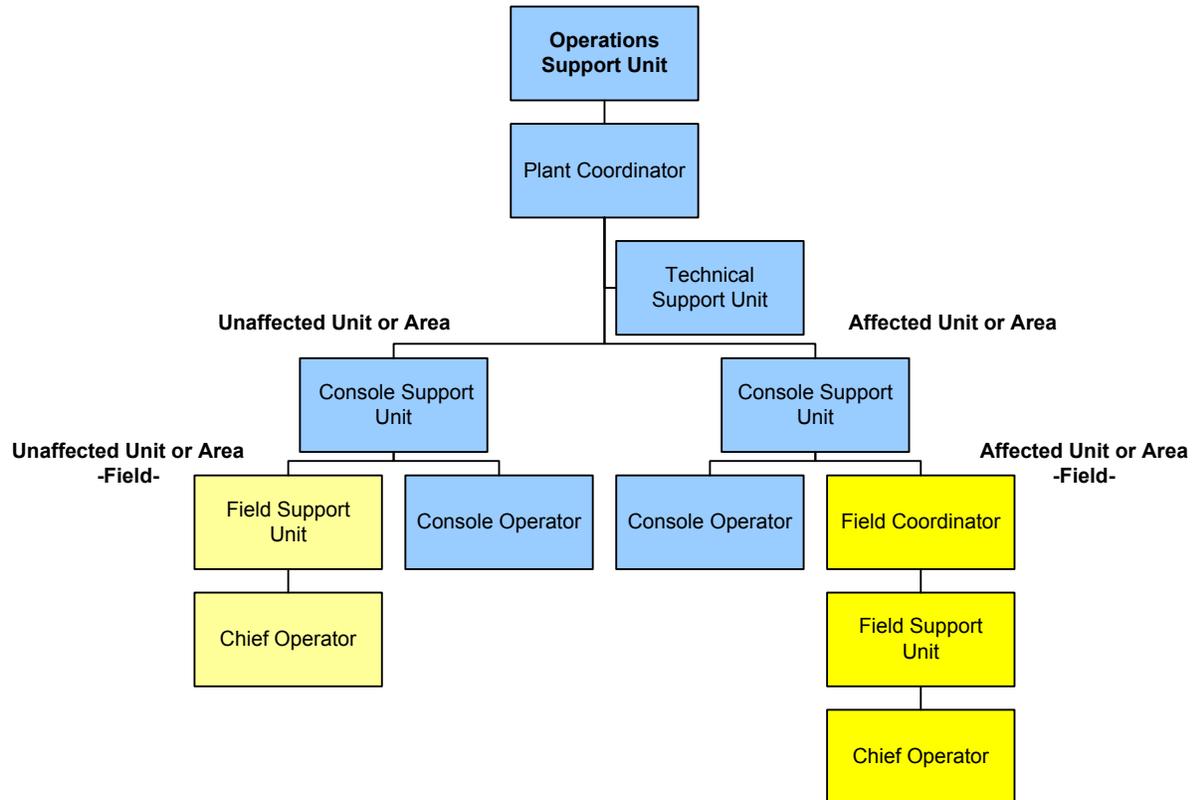
FLOWCHART



DOCUMENT NO:	HSE-EAP-006	PAGE:	8 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

PROCEDURE

OPERATIONS SUPPORT UNIT



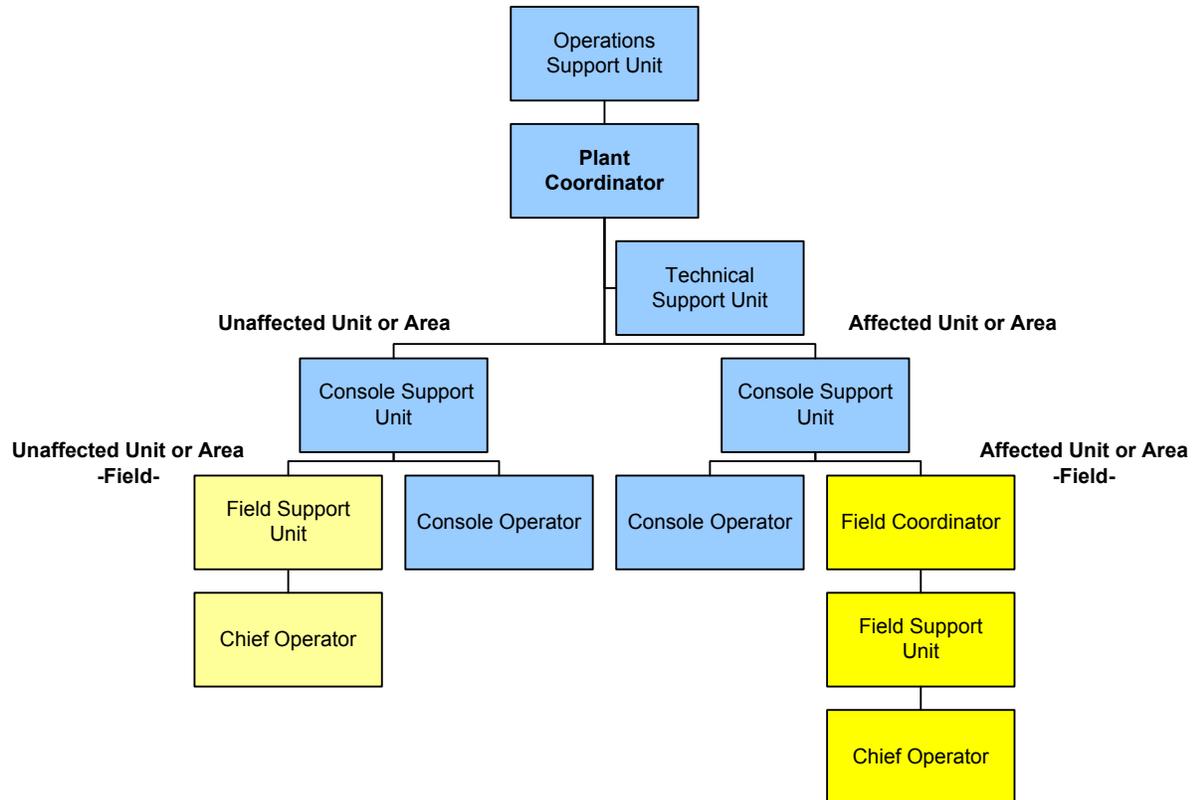
Assignment:	<ul style="list-style-type: none"> Operations Superintendent Central Control & Logistics.
Alternate:	<ul style="list-style-type: none"> Assigned Operations Superintendent Assigned Operations Planner
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Unit Leader reports to the Central Control Room (CCR) during Alert 2 response or greater.
Reporting:	<ul style="list-style-type: none"> Reports to the Operations Coordinator (Operations Planning & Support) in EOC.
Communications:	<ul style="list-style-type: none"> Communicates by Ops - 1 radio channel or phone to the Operations Coordinator in the EOC.

DOCUMENT NO:	HSE-EAP-006	PAGE:	9 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Operations Support Unit
<ul style="list-style-type: none"> • Directly supports manufacturing emergency response efforts. Works with and supports the Plant Coordinator in evaluating manufacturing response actions.
<ul style="list-style-type: none"> • Assists the Plant Coordinator in affecting proper emergency shutdown and startup procedures. When activated, this position assists the Plant Coordinator with short-term and long term operations shutdowns and other process adjustments.
<ul style="list-style-type: none"> • Establishes and maintains communications with the Operations Coordinator in EOC. Provides operations situation report to the Operations Coordinator per request or established schedules. Responsible for collecting, processing and organizing manufacturing situation information.
<ul style="list-style-type: none"> • If requested, may assist in attaining Operations accountability or follow-up information.
<ul style="list-style-type: none"> • Remains in the Central Control Room while the response is in progress.
<ul style="list-style-type: none"> • Coordinates operations logistical support, to include maintenance, through the Operations Coordinator in EOC.
<ul style="list-style-type: none"> • Works with Plant Coordinator and Operations Planning and Support members (EOC) to develop short and long term strategic plans.
<ul style="list-style-type: none"> • Assists Plant Coordinator with planning efforts to including resource staffing.
<ul style="list-style-type: none"> • Assists and supports the Plant Coordinator with their duties and responsibilities as required.
<ul style="list-style-type: none"> • Responsible for deactivation of other Emergency Operations Support Units, Coordinators, or personnel in their area of responsibility. Ensures proper staffing of these positions per the needs of the event.

DOCUMENT NO:	HSE-EAP-006	PAGE:	10 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

PLANT COORDINATOR



Assignment:	<ul style="list-style-type: none"> Plant Shift Superintendent
Alternate:	<ul style="list-style-type: none"> Assigned First Line Supervisor
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to Central Control Room on all Alerts
Reporting:	<ul style="list-style-type: none"> Reports to Operations Support – Central Control when established.
Communications:	<ul style="list-style-type: none"> Uses radio designation “Plant Coordinator” Communicates on Ops-1 radio channel and by phone. May communicate on HSE-1 radio channel to Incident Command if required. Communicates with Field Coordinator in the Field Command Post (FCP) on the Ops-1 radio channel or by phone. Communicates directly with Operations Support Unit and others in the Central Control Room (CCR). Communicates directly with Console Operators or if established with the Console Support Units.

DOCUMENT NO:	HSE-EAP-006	PAGE:	11 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Plant Coordinator

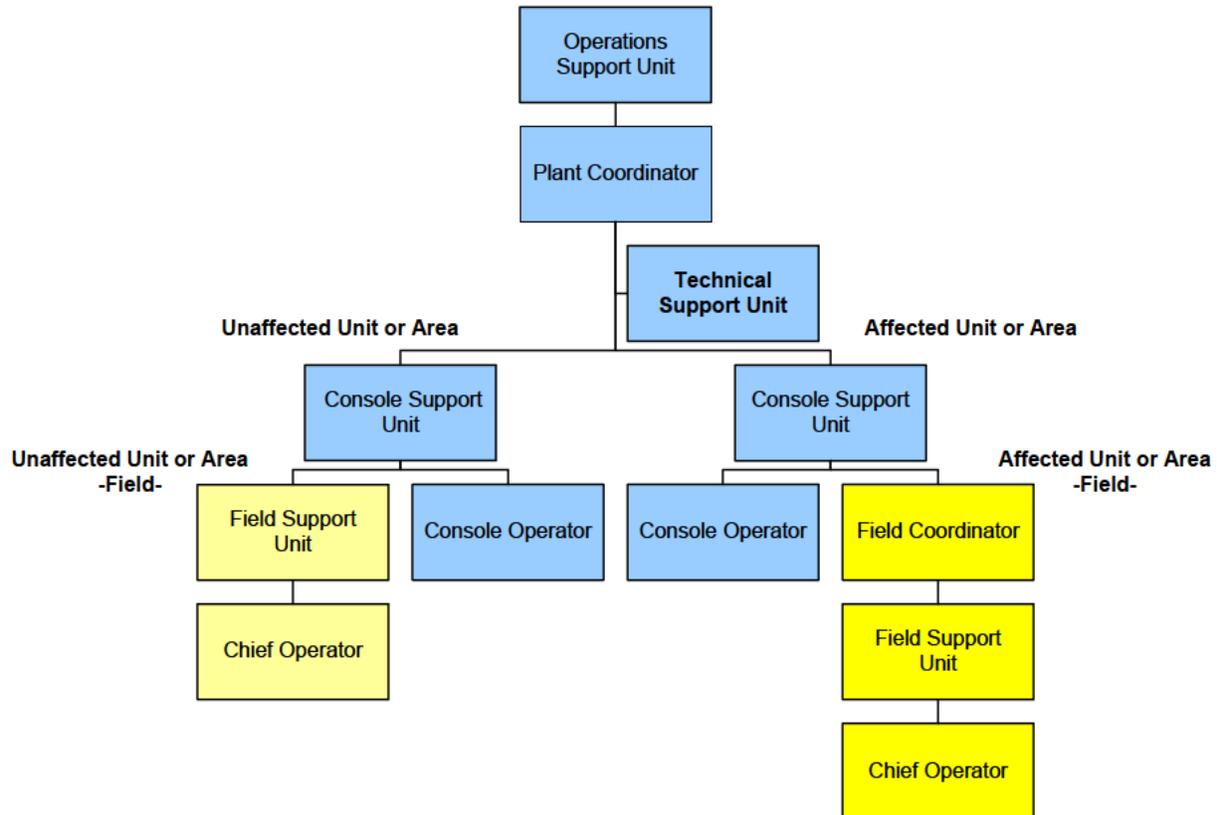
- Provides direction and management relating to refinery manufacturing operations emergency response. Directs implementation of operational strategies into tactical actions aimed at minimizing impact to the refinery.
- Directs activities in order to minimize impact to the refinery. Evaluates manufacturing response actions. Affects and ensures proper emergency shutdown and startup procedures are initiated. Maintains awareness of affected unit or area operating status. Maintains awareness of all plant operations.
- Interacts with Console Operators, or when established, Console Support Units to ensure that unit related problems and significant process related concerns are taken into account and appropriate adjustments are made. Provides operating orders to console operators as directed by emergency procedures and recommendations from the Field Coordinator.
- Facilitates and ensures that process adjustments are made to minimize the effects of the emergency in both affected and non-affected areas.
- Exercises supervisory control over the operating consoles.
- Interact with Console Operators to facilitate and ensure that appropriate emergency systems are activated in the affected unit or area.
- Ensures that unit related problems and significant process related concerns are taken into account in conducting emergency response action. Interacts with affected unit Console Operators to facilitate and ensure emergency actions are coordinated and communicated through the Field Coordinator and Incident Command.
- Remains in the Central Control Room while the response is in progress.
- Responsible for accountability of Operations personnel. Ensures the gathering and reporting of accountability information to the Facility Accountability Coordinator (FAC) in the EOC.
- Ensures that prompt evacuation orders are provided to maintain personnel safety.
- Ensures the collection, processing and organizing of manufacturing situation information.
- Works with Operations Planning and Support on manufacturing strategic issues for development of short term and long term plans. Implements strategic direction to accomplish tactical actions.

DOCUMENT NO:	HSE-EAP-006	PAGE:	12 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

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|---|
| <ul style="list-style-type: none"> • Maintains communications and reports information as necessary to the Field Coordinator. When established, communicates and reports information through the Console Support Units. |
| <ul style="list-style-type: none"> • Ensures adequate communications between console operators. |
| <ul style="list-style-type: none"> • Is the primary “Qualified Individual” for a marine spill response emergency. |
| <ul style="list-style-type: none"> • Orders Operations logistical support, to include maintenance, through the Operations Coordinator in EOC. |
| <ul style="list-style-type: none"> • Responsible for proper agency notification and CAER Alert issuance. |
| <ul style="list-style-type: none"> • Plans and ensures adequate staffing of operational personnel and console operators. |
| <ul style="list-style-type: none"> • Oversees overall safety of plant operations personnel. |
| <ul style="list-style-type: none"> • Requests emergency authorization/access and site security/control. |

DOCUMENT NO:	HSE-EAP-006	PAGE:	13 of 26
DOCUMENT NAME:			
EMERGENCY OPERATIONS - MANUFACTURING			

TECHNICAL SUPPORT UNIT



Assignment:	<ul style="list-style-type: none"> • Technical Superintendent, unaffected unit or area
Alternate:	<ul style="list-style-type: none"> • Assigned Engineer
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Unit Leader reports to the EOC during Alert 2 response or greater.
Reporting:	<ul style="list-style-type: none"> • Reports to the Plant Coordinator in the CCR.
Communications:	<ul style="list-style-type: none"> • Communicates directly with Plant Coordinator. • Communicates directly with Console Support Units or Console Operators in the CCR as required. • Communicates directly, by phone or by Ops - 1 radio channel with other Process Engineers.

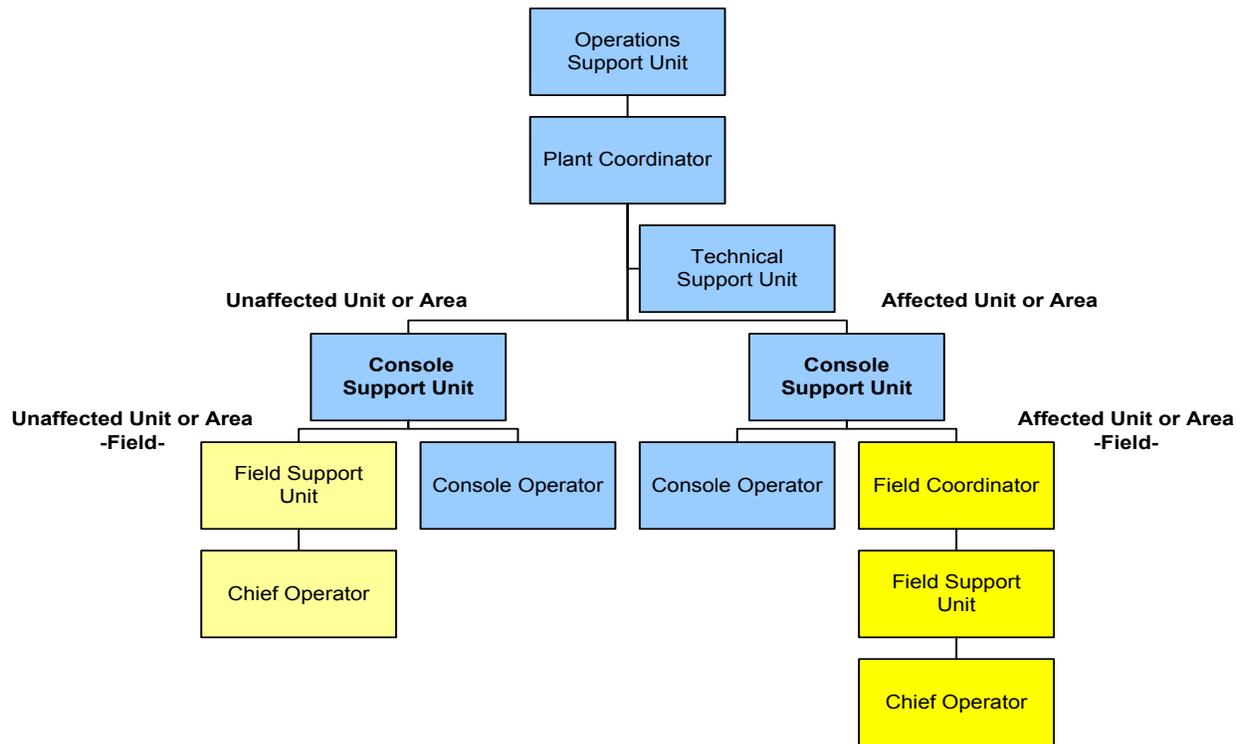
DOCUMENT NO:	HSE-EAP-006	PAGE:	14 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Technical Support Unit

- Assembles engineering staff to support emergency operations field efforts. Coordinates and assigns process technical support to operating units/areas and the Central Control Room (CCR). Assigns staff to various field technical functions as required.
- Participates in the development and data gathering for analysis and subsequent planning efforts.
- Ensures support of data gathering for agency reporting.
- Assists manufacturing with process engineering issues.
- Evaluates operations response actions.
- Works with and communicates with Technical Support Unit in EOC to ensure proper engineering resource management.

DOCUMENT NO:	HSE-EAP-006	PAGE:	15 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

CONSOLE SUPPORT UNIT



Assignment:	<ul style="list-style-type: none"> Operations Planner
Alternate:	<ul style="list-style-type: none"> Assigned Area Supervisor
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response	<ul style="list-style-type: none"> Unit Leader reports to assigned console in the CCR during an Alert 2 response or greater. If their respective unit is affected by emergency, Unit Leader may report to the operating console during an Alert 1 response.
Reporting	<ul style="list-style-type: none"> Reports to the Plant Coordinator in the CCR
Communications	<ul style="list-style-type: none"> If their unit or area is affected, communicates with the Field Coordinator in the Field Command Post (FCP) by Ops-1 radio channel or phone. If their unit or area is unaffected, communicates with Field Support Unit on unit or area assigned radio channel. Communicates directly with the Plant Coordinator in the CCR. Coordinates directly with the Console Operator.

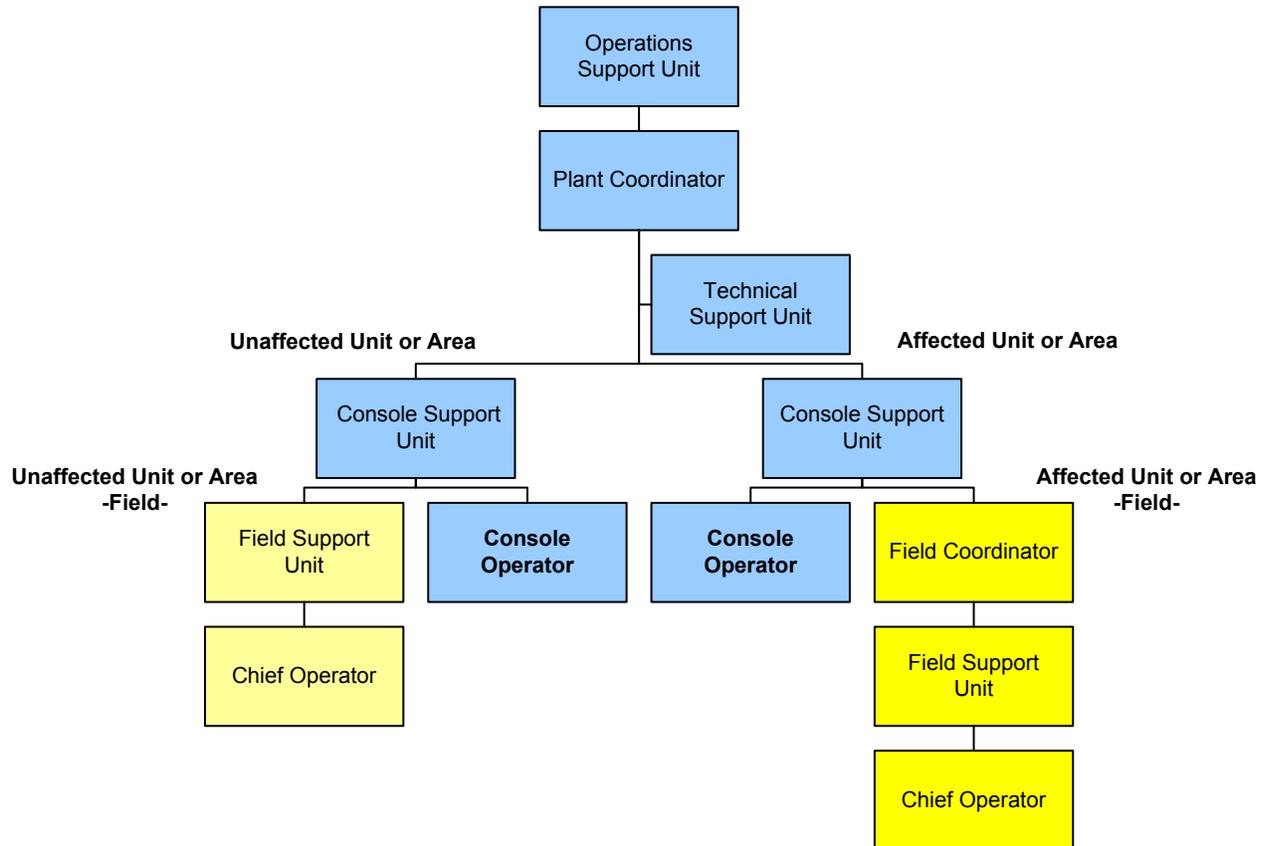
DOCUMENT NO:	HSE-EAP-006	PAGE:	16 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Console Support Unit

- When activated, the Console Support Unit assists the Console Operator in their efforts to adjust processes and shut down equipment in accordance with emergency operating procedures.
- Assists Console Operators with implementation of response strategies.
- Ensures accountability of operating personnel in assigned area.
- Reports information as required to the Plant Coordinator. Maintains communications and reports information as necessary to the Field Coordinator.
- Assists the Console with communications to other operations personnel or outside/external groups, i.e. fuel, hydrogen, oxygen, power, water treatment and pipeline operations.
- Interacts and gathers operations situation reports from Console Operators, Field Support Units and the Field Coordinator. These reports are provided to assist the Plant Coordinator in future planning efforts.
- Provides input into operational strategic direction for manufacturing emergency response efforts.
- Evaluates manufacturing response actions. Maintains awareness of affected unit or area operating status. Maintains awareness of all plant operating status.
- Remains in the Central Control Room while the response is in progress unless otherwise assigned.
- Coordinates and ensures adequate communications between console operators.
- Orders Operations logistical support, to include maintenance, through the Plant Coordinator.
- Plans and ensures adequate staffing of operational personnel and console operators.
- Exercises responsibility for protecting product and equipment in assigned area.
- May request respective operations or analytical support staff necessary to assist effort.
- Gathers data for analysis and subsequent planning efforts.
- Ensures control of refinery tank farm and associated pipelines in respective area or responsibility.

DOCUMENT NO:	HSE-EAP-006	PAGE:	17 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

CONSOLE OPERATOR



Assignment:	<ul style="list-style-type: none"> • Console Operator
Alternate:	<ul style="list-style-type: none"> • Assigned Console Operator
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Staffs unit or area operations console at all times
Reporting:	<ul style="list-style-type: none"> • Reports to Plant Coordinator • When established, reports to the Console Support Unit in the CCR.
Communications:	<ul style="list-style-type: none"> • Communicates directly with Plant Coordinator, Console Support Unit and other Console Operators. • Communicates with Chief Operator and Unit operators on Unit assigned radio channel.

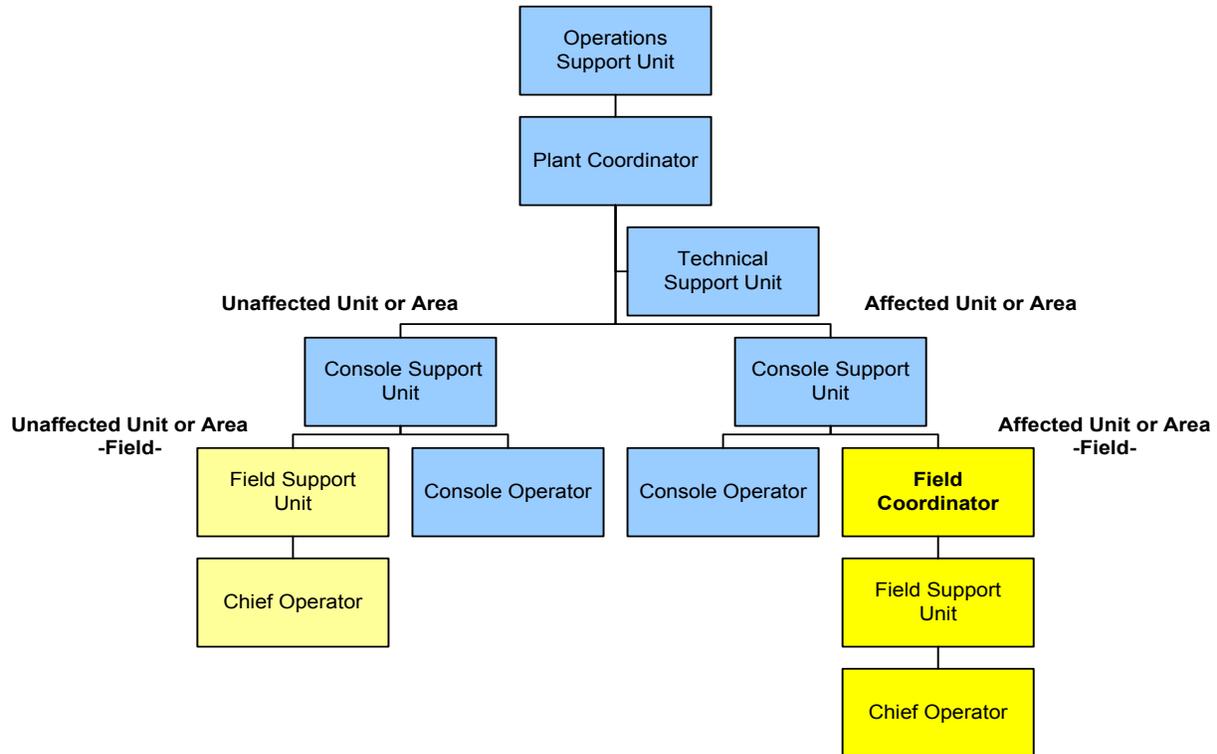
DOCUMENT NO:	HSE-EAP-006	PAGE:	18 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Console Operator

- Gathers personnel accountability reports from the Chief Operator and pass them on to the Plant Coordinator or Console Support Unit when activated.
- Console Operators of both affected and non-affected process units will evaluate the impact of the emergency on their respective process units/areas. Following this evaluation, the Console Operator may begin shutting down equipment or making process adjustments in accordance with emergency or other operating procedures. Follows standard and emergency operating procedures appropriate for the incident.
- Maintains contact with the unit Chief Operator on strategic and tactical issues. The Console Operators communicate directly with the Plant Coordinator or when activated with Console Support Units. Works with Chief Operator regarding unit shutdown actions or other process adjustments.
- Advises Chief Operator of unit conditions and changes.
- Interacts with other Console Operators to ensure that the impact to other units/areas is considered and adjusted.
- Maintains a status awareness of unit operations.
- Coordinates with Chief Operators, Plant Coordinator and Console Support Unit respectively to make appropriate process adjustments.
- Assigns and directs unit operator actions and activities in accordance with standard operating procedures and emergency operating procedures.

DOCUMENT NO:	HSE-EAP-006	PAGE:	19 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

FIELD COORDINATOR



Assignment:	<ul style="list-style-type: none"> Assigned First Line Supervisor (ICS Qualified)
Alternate:	<ul style="list-style-type: none"> Other assigned Field Support Unit (ICS Qualified)
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to scene Field Command Post (FCP) on all Alerts affecting process unit or area operations.
Reporting:	<ul style="list-style-type: none"> Reports to Plant Coordinator When established, reports to Console Support Unit over affected unit or areas.
Communications:	<ul style="list-style-type: none"> Uses radio designation "Field Coordinator". Communicates on Operations radio channel or by phone to Plant Coordinator or Console Support Unit in the CCR. Communicates by Operations radio channel to the affected unit or area's Field Support Unit or when established Field Support Unit. As necessary, communicates on HSE-1 radio channel to emergency response personnel. Communicates directly with Incident Command in the FCP.

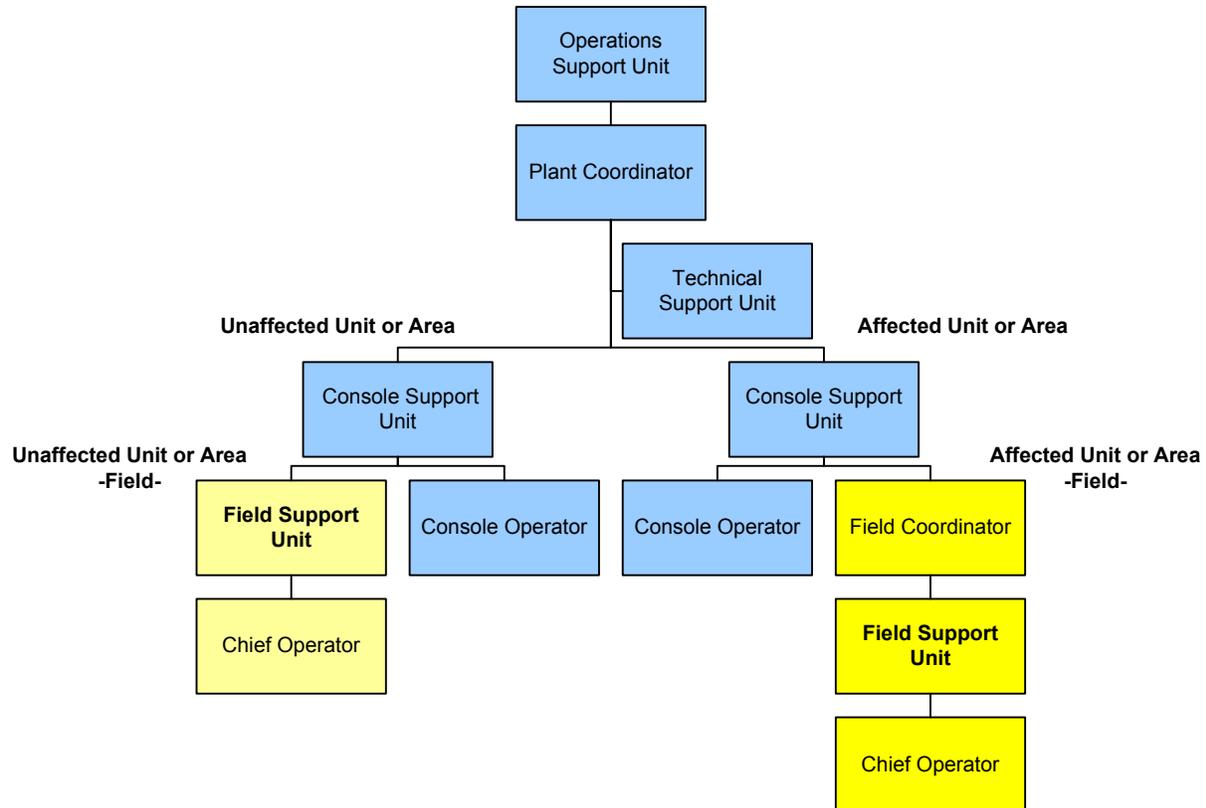
DOCUMENT NO:	HSE-EAP-006	PAGE:	20 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Field Coordinator

- Ensures accountability and life safety of all operations and non-essential personnel in affected area. Works with Incident Command to issues prompt evacuation orders for affected facility areas as necessary.
- Primary liaison between process unit operations and the Emergency Response Group through the Incident Commander. The Field Coordinator is unified with Incident Command in the Field Command Post (FCP).
- Works, in a unified manner, with Incident Command to plan and implement response goals and objectives.
- Establishes and maintains contact with the affected process unit or area Field Support Unit. Interacts with field operations personnel to ensure that unit related problems and significant process concerns are taken into account when conducting response actions.
- Works with the affected unit or areas operations group and Emergency Response to establish and implement strategic and tactical response plans to be established for overall emergency and hazard control. Provides input into operational strategic direction for manufacturing emergency response efforts.
- Reports information as necessary to the Plant Coordinator or Console Support Unit. Attains approvals from the Plant Coordinator for local strategic and tactical plans as necessary.
- May gather process information for future operational strategic plan development.
- Evaluates manufacturing response actions. Maintains awareness of affected unit or area operating status.
- Remains at the scene of the emergency while the response is in progress.
- If requested, may order Operations logistical support, to include maintenance, through the Plant Coordinator or the Console Support Unit.
- Ensures and may assist with planning to adequately staff of operations personnel at emergency site.
- Oversees overall safety of affected unit operations personnel.

DOCUMENT NO:	HSE-EAP-006	PAGE:	21 of 26
DOCUMENT NAME:			
EMERGENCY OPERATIONS - MANUFACTURING			

FIELD SUPPORT UNIT



Assignment:	<ul style="list-style-type: none"> Area Supervisor (Unit Leader) and First Line Supervisor
Alternate:	<ul style="list-style-type: none"> Assigned Area Supervisor Assigned First Line Supervisor
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response	<ul style="list-style-type: none"> For Alert 1 responses, the affected units First Line Supervisor will respond to the operating unit or area and assume the Field Support Unit Leader position. Area Supervisors may respond if necessary. During an Alert 2 or greater events, the Area Supervisor and the First Line Supervisor will report to their respective unit or area.
Reporting	<ul style="list-style-type: none"> If their unit or area is affected, Unit Leader reports to the Field Coordinator. If their unit or area is unaffected, reports to the Plant Coordinator or if established the Console Support Unit.
Communications	<ul style="list-style-type: none"> If their respective unit or area is affected, communicates by Ops-1 radio or by phone to Field

DOCUMENT NO:	HSE-EAP-006	PAGE:	22 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

	<p>Coordinator. May communicate directly with Emergency Response Operations personnel in the field.</p> <ul style="list-style-type: none"> • If unit or area is unaffected, communicates by assigned unit or area operations channel with Console Support Unit. • Communicates with Chief Operator directly or on the assigned unit or area radio channel.
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Duties and Responsibilities: Field Support Unit	
	<ul style="list-style-type: none"> • Ensures operator accountability and life safety issues are addressed
	<ul style="list-style-type: none"> • Reports to the field (unit or process area) and supervises plant-operating functions in their respective areas. Field Support Units interact at the field level for decisions and implementation of response strategies. •
	<ul style="list-style-type: none"> • Gathers appropriate information to facilitate the initiation of emergency actions and associated process changes. Interacts and works directly with the Chief Operator to ensure appropriate emergency operating procedures are initiated as required. Monitors conditions affecting the need for emergency shutdowns.
	<ul style="list-style-type: none"> • Maintains awareness of the status of unit operations in assigned area.
	<ul style="list-style-type: none"> • Oversees safety of unit or area operators. Ensures operations personnel adhere to prescribed safety plans, prescribed personal protective equipment and established control zones.
	<ul style="list-style-type: none"> • May work directly with Emergency Response Operations personnel in planning and implementing tactical actions. Ensures adequate communications between Operations and Emergency Response Team personnel.
	<ul style="list-style-type: none"> • Communicate with their respective Console Support Unit, or if their unit is affected, with the Field Coordinator to provide necessary information for support and response planning efforts.

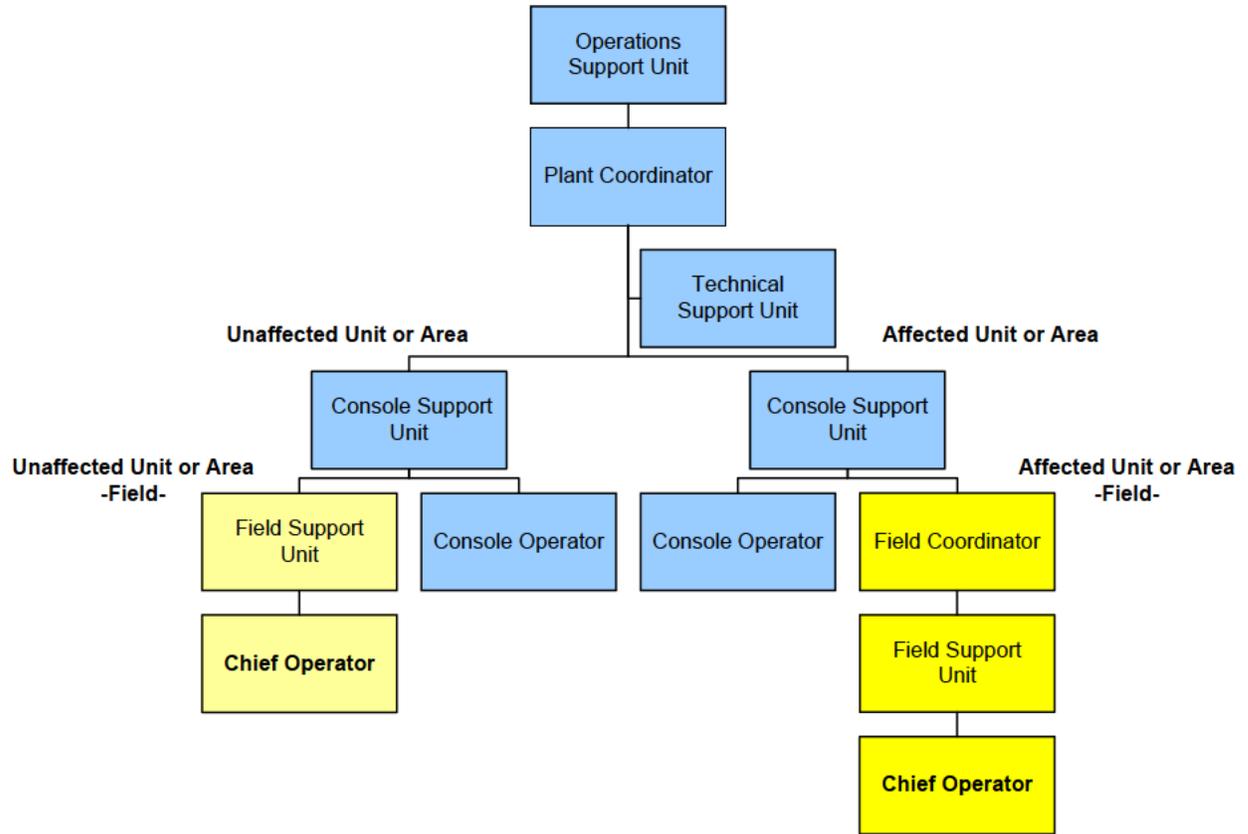
DOCUMENT NO:	HSE-EAP-006	PAGE:	23 of 26
DOCUMENT NAME: EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Field Support Unit

- Ensure appropriate emergency shutdown and startup procedures are initiated for refinery systems and equipment. Monitors conditions affecting the need for emergency shutdown(s) in assigned area.
- Plans or ensure planning to adequately staff of operations personnel at emergency site.
- Exercises responsibility for protecting product and equipment in assigned unit or area.
- Requests maintenance and supply support through the Field Coordinator or Field Support Unit.
- Requests assembly or respective operations or analytical support staff necessary to assist effort.

DOCUMENT NO:	HSE-EAP-006	PAGE:	24 OF 26
DOCUMENT NAME:			
EMERGENCY OPERATIONS - MANUFACTURING			

CHIEF OPERATOR



Assignment:	<ul style="list-style-type: none"> Chief Operator
Alternate:	<ul style="list-style-type: none"> Assigned Operator
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Reports to the unit or area on any Alerts
Reporting:	<ul style="list-style-type: none"> Reports to Field Support Unit
Communications:	<ul style="list-style-type: none"> Communicates with Field Support Unit on assigned unit or area operations radio channel. Communicates with Console Operator on respective unit or area radio channel. Communicates with other operators on unit or area radio channel. Communicates directly or on HSE-1 radio to Incident Command during the initial stages of the event for accountability reporting. Communicates directly with Emergency Response Operations personnel for planning and implementation of tactical action plans.

DOCUMENT NO:	HSE-EAP-006	PAGE:	25 OF 26
DOCUMENT NAME:			
EMERGENCY OPERATIONS - MANUFACTURING			

Duties and Responsibilities: Chief Operator
<ul style="list-style-type: none"> Ensures that the Main Gate Dispatcher is notified of the emergency.
<ul style="list-style-type: none"> As per activated evacuation order, Chief Operators are responsible for gathering and reporting operations accountability to their respective Console Operator. Chief Operators must also assure that non-essential personnel have cleared their unit. If their unit or area is affected unit Chief Operator shall also report accountability to Incident Command on scene.
<ul style="list-style-type: none"> Supports safe emergency operations by ensuring Operators follow safety plans to include the proper adherence to prescribed personal protective equipment and control zone requirements.
<ul style="list-style-type: none"> Maintains awareness of Operators in their unit or area during emergency event.
<ul style="list-style-type: none"> Direct and implement operations response efforts and emergency shutdowns. The Chief Operator works with the Console Operator to direct unit personnel conducting operations response and shutdown efforts.
<ul style="list-style-type: none"> Works with Field Support Unit to ensure Operators are following prescribed safety measures.
<ul style="list-style-type: none"> Maintains communications with the Console Operator. The Chief Operator will maintain contact with the Field Support Unit on strategic matters.
<ul style="list-style-type: none"> Interact and works with Emergency Response Operations Section personnel to plan and implement tactical actions.
<ul style="list-style-type: none"> Activates or ensures activation of fixed manual or automatic fire protection systems and other safety systems per procedures.
<ul style="list-style-type: none"> Follows standard and emergency operating procedures appropriate for the incident.
<ul style="list-style-type: none"> Reports information as necessary to the Field Support Unit.

DOCUMENT NO:	HSE-EAP-006	PAGE:	26 OF 26
DOCUMENT NAME:			
EMERGENCY OPERATIONS - MANUFACTURING			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-007	Page: 1 OF 30	Approval Date:	06/30/2011
Document Title:	INCIDENT COMMAND SYSTEM AND ORGANIZATION				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: JEFF WINDHAM	<i>Electronic Signature On File</i>		Review Date:	05/09/2011	

TABLE OF CONTENTS

Incident Command System	2
Incident Command / Incident Management Facilities	3
Incident Command Organization	4
Command Staff Positions	4
Operations / Tactical Supervision	5
Incident Command Organization Chart	8
Roles and Responsibilities	9
Incident Command	9
Safety Officer	12
Industrial Hygiene Officer	14
Environmental Officer	16
Security Coordinator	18
Operations Section Chief	20
Staging Area Manager	22
Branch Director(s)	24
Division Supervisor(s)	26
Group Supervisor(s)	28
Revision Summary	30

DOCUMENT NO:	HSE-EAP-007	PAGE:	2 OF 30
DOCUMENT NAME: INCIDENT COMMAND SYSTEM & ORGANIZATION			

INCIDENT COMMAND SYSTEM (ICS)

The Incident Command System (ICS) is the national standard process for managing responses to emergency incidents. The ICS consists of personnel, facilities, equipment, communications, and procedures, all operating within a common organizational structure to gain control of and mitigate an incident. The ICS can develop into a complex organization with the major functions being Command, Operations, Planning, Logistics, Liaison, and Safety.

The ICS is designed to allow for multi-agency adoption within industrial, federal, state, and local emergency agencies. Therefore, terminology used in the ICS is designed to be acceptable and understandable to across different emergency management organizations.

Houston Refining, LP has adopted the CIMA Incident Command System for use during all emergencies that occur at the facility.

Organization of the Incident Command System begins to develop from the time that initial resources arrive at an incident. The organization starts with management of major functions initially being the responsibility of one or just a few persons. As the incident develops in size and / or complexity, activities management is assigned to additional individuals in order to maintain a reasonable span of control. Necessary aspects of the organization are maintained through all active phases of the incident. Command is terminated at the point that active operations or incident hazards no longer present a need for operational control.

The basic organizational structure is also applicable to small incidents and incidents not directly involving releases, such as hurricanes, floods, rescues, or medical incidents. The system's organizational structure is able to adapt to any emergency incident or planned event that might occur on the facility.

DOCUMENT NO:	HSE-EAP-007	PAGE:	3 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

INCIDENT COMMAND / INCIDENT MANAGEMENT FACILITIES

Field Command Post: The Command Post is the location from which the Incident Commander, Field Coordinator and necessary support staff operate to direct and coordinate incident control activities. The Command Post will normally be in the Command Vehicle near the scene of the incident. In some cases however, the Command Post may be located away from the incident scene.

Emergency Operations Center (EOC)

The Emergency Operations Center is the location from which the Emergency Operations organization operates. The primary EOC is in the Administration Building – HSSE Wing. The EOC is provided with resources and equipment necessary for the EOC staff to perform their responsibilities including access to emergency plans, radios, telephones systems, a fax machine, checklists, plot plans, and networked computer systems.

Alternate EOC

The Alternate EOC is located at the Houston Refinery Training Center at 317 Allen Genoa Road in the Computer Training Room. Limited radio capability is available at the Alternate EOC via portable base radio stations and handheld radios. Additional handheld radios should be obtained prior to moving to the Alternate EOC. Electronic resource material such as emergency plans, plot plans, checklists, and telephone numbers / call lists are accessible from Alternate EOC networked computer systems. Hard copy material must be moved when the Alternate EOC is established.

Central Control Room Building (CCRB)

The CCRB is utilized by the Emergency Operations – Manufacturing Organization to provide tactical level operational support to the EOC.

Logistics Support Center

The Logistics Support Center is the locations to which logistics support personnel not directly assigned to EOC report to await orders from the Logistics Coordinator. The logistics Support Center is located in the Administration Building HSSE Wing – Old EOC Conference Room.

Media Information Center

The Media Information Center is the location from which the Public Information Officer or designee will provide information and briefings to members of the media. The Media Information Center will normally be established in Training Room D in the HRO Training Center when necessary. If that area is inadequate, the Employee Recreation Center or the Admin Building Main Office Conference Room can be utilized.

Agency Information Center

The Agency Information Center is the location from which information is shared with representatives of regulatory agencies. The Agency Information Center will normally be established in the Administration Building – West Wing Conference Room C. In the event Conference Room C is unavailable or inadequate, the Administration Building Main Office Conference Room should be utilized.

DOCUMENT NO:	HSE-EAP-007	PAGE:	4 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Staging Area

The Staging Area is a location near the incident, designated by Command to which unassigned emergency response resources will respond, check-in for accountability and wait for an assignment.

CIMA Staging Area

A CIMA Staging Area is established for temporary location of mutual aid resources. The staging areas are instituted by Command to control non-refinery resources that are not immediately assigned. Incoming mutual aid resources report to CIMA staging where they are checked in until requested by Command or the Operations Section Chief. The CIMA Staging Area Manager manages all aspects of the area. Primary CIMA Staging is located in the far east side of the Maintenance Parking Lot. Alternative CIMA Staging is located at the Credit Union Parking Lot or in the Lawndale Road corridor.

Medical Department: The HRO Medical Department may be utilized for various incident medical functions including but not limited to triage, treatment, or rehabilitation support.

Landing Zone (LZ): (b) (7)(F), (b) (3)

COMMAND STAFF

Incident Command

“Command” is the radio identifier used to distinguish the individual in charge of emergency response team efforts. The first arriving ERT officer establishes Command. If the Field Coordinator is on scene first, initial Command responsibilities become theirs. Command will then be transitioned to an appropriate ERT officer upon their arrival. See [Duties and Responsibilities: Incident Commander](#)

Safety Officer

A Safety Officer is established by Emergency Response – Command at every emergency involving a release of hazardous materials for the purpose of evaluating and monitoring safety hazards and related conditions. A Safety Officer may be established on non-release emergencies as well. Evaluation of all field operations and development of the Site Safety Plan is performed by or under the direction of the Safety Officer. Additional resources will be assigned as necessary to assist in safety observations during large incidents. When other safety assistants are established, they will be coordinated through the Safety Officer. See [Duties and Responsibilities: Safety Officer](#)

Industrial Hygiene Officer

The on-call Health & Safety Representative reports to the Command Post and becomes the Industrial Hygiene Officer during emergencies involving or having a potential to involve a release. With Command, the IH Officer will identify the materials involved, develop a

DOCUMENT NO:	HSE-EAP-007	PAGE:	5 OF 30
DOCUMENT NAME: INCIDENT COMMAND SYSTEM & ORGANIZATION			

monitoring strategy, and coordinate tactical implementation of the monitoring plan. The Industrial Hygiene Officer, will also support the Safety Officer in developing the Site Safety Plan. During minor events, the IH Officer personally implements monitoring actions or contacts additional Health and Safety resources as necessary. For large events, the IH Officer coordinates and supervises all industrial hygiene activities from the Command Van. See [Duties and Responsibilities: Industrial Hygiene Officer](#)

Environmental Officer

The on-call Environmental Representative reports to the Command Post and becomes the Environmental Officer during emergencies involving or having a potential to involve a release. With Command, the Environmental Officer will ensure proper notifications are made and that environmentally focused mitigation efforts are appropriate. The Environmental Officer is also responsible for coordinating agency interface during Alert 1 events. The Environmental Officer will attain additional resources and coordinate on-scene environmental support activities, as necessary. See [Duties and Responsibilities: Environmental Officer](#)

Security Coordinator

Security Patrol Unit 49 responds directly to the scene and checks in with Command. The Security Coordinator will immediately begin securing the area. The Security Coordinator will ensure communications with Command and will supervise all other personnel involved with scene security. See [Duties and Responsibilities: Security Coordinator](#)

Staging Area Manager

The Staging Area Manager position is established by Command to manage unassigned resources. During Mutual Aid events, a Channel Industries Mutual Aid (CIMA) Emergency Response Specialist may be asked to work with the Houston Refinery Staging Area Manager to manage outside resources. The Staging Area Manager establishes the Staging Area. The Staging Area Manager will track ERT resources as assigned or unassigned. The Staging Area Manager will dispatch resources to assignments as requested by Command or the Operations Section Chief. See [Duties and Responsibilities: Staging Area Manager](#)

Operations / Tactical Supervision

Operations Section Chief

As an incident organization grows or incident complexity becomes apparent, Command may establish an Operations Section Chief to direct deployment of resources, and oversee control and coordination of Branch Directors and Division / Group Supervisors. See [Duties and Responsibilities: Operations Section Chief](#)

Branch Director(s)

Branch Directors may be established as an intermediate supervisory layer of the incident command organization to maintain an effective span of control. When established, Branch directors will report to the Operations Section Chief and supervise Division / group Supervisors. See [Duties and Responsibilities: Branch Directors](#)

DOCUMENT NO:	HSE-EAP-007	PAGE:	6 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Tactical Divisions and Groups

Divisions and Groups are tactical level supervisors assembled to direct tactical action plans. Division / Group supervisors oversee task level resources assigned to them.

Division Supervisor(s)

Division Supervisors oversee operations within a defined geographical area and are responsible for supervision and accountability of assigned task level resources (i.e. North, South, or 1st. Floor Division). Division Supervisors will use their Division designation as a radio identifier (North Division). See [Duties and Responsibilities: Division Supervisor\(s\)](#)

Group Supervisor(s)

Group Supervisors oversee operations of a functional discipline (i.e., Hazmat, Rescue, or Medical Group) without regard for geographic division and are responsible for supervision and accountability of assigned task level resources. Group Supervisors will use their Group designation as a radio identifier (Hazmat Group). See [Duties and Responsibilities: Group Supervisor\(s\)](#)

Spill Group (Oil Spill Water)

The Spill Group Supervisor directs emergency response efforts relating to the control of spills on waterways. When established, the Spill Group will coordinate and direct the deployment of boats and boom to control a spill.

The Spill Group Supervisor will report to the affected dock or area and coordinate the operations from the shore position. From the dock, the Spill Group Supervisor will communicate tactical directions to spill team members deployed on shore and in boats.

The Spill Group may also be required to communicate or direct outside / contract spill personnel working in the affected area.

Hazmat Group

The Hazmat Group Supervisor directs emergency response efforts relating to the control of hazardous material releases. When established, the Hazmat Group Supervisor directly coordinates advanced tactical hazmat operations and supervises task level hazmat team leaders.

For further procedures see [Hazardous Materials Response Plan HSE-EAP-009](#)

Medical Group

When established, the Medical Group Supervisor directs response efforts in relating to Emergency Medical Services (EMS). The Medical Group may also be given the responsibility to set up a rehab area for evaluating Emergency Response Team (ERT) members.

The Medical Group will coordinate efforts with the Houston Fire Department (HFD) EMS Division and other medical service entities. The Operations Section Chief, Branch Director, or the Medical Group will normally have the HFD EMS Supervisor assigned with them to better manage the incident.

DOCUMENT NO:	HSE-EAP-007	PAGE:	7 OF 30
DOCUMENT NAME: INCIDENT COMMAND SYSTEM & ORGANIZATION			

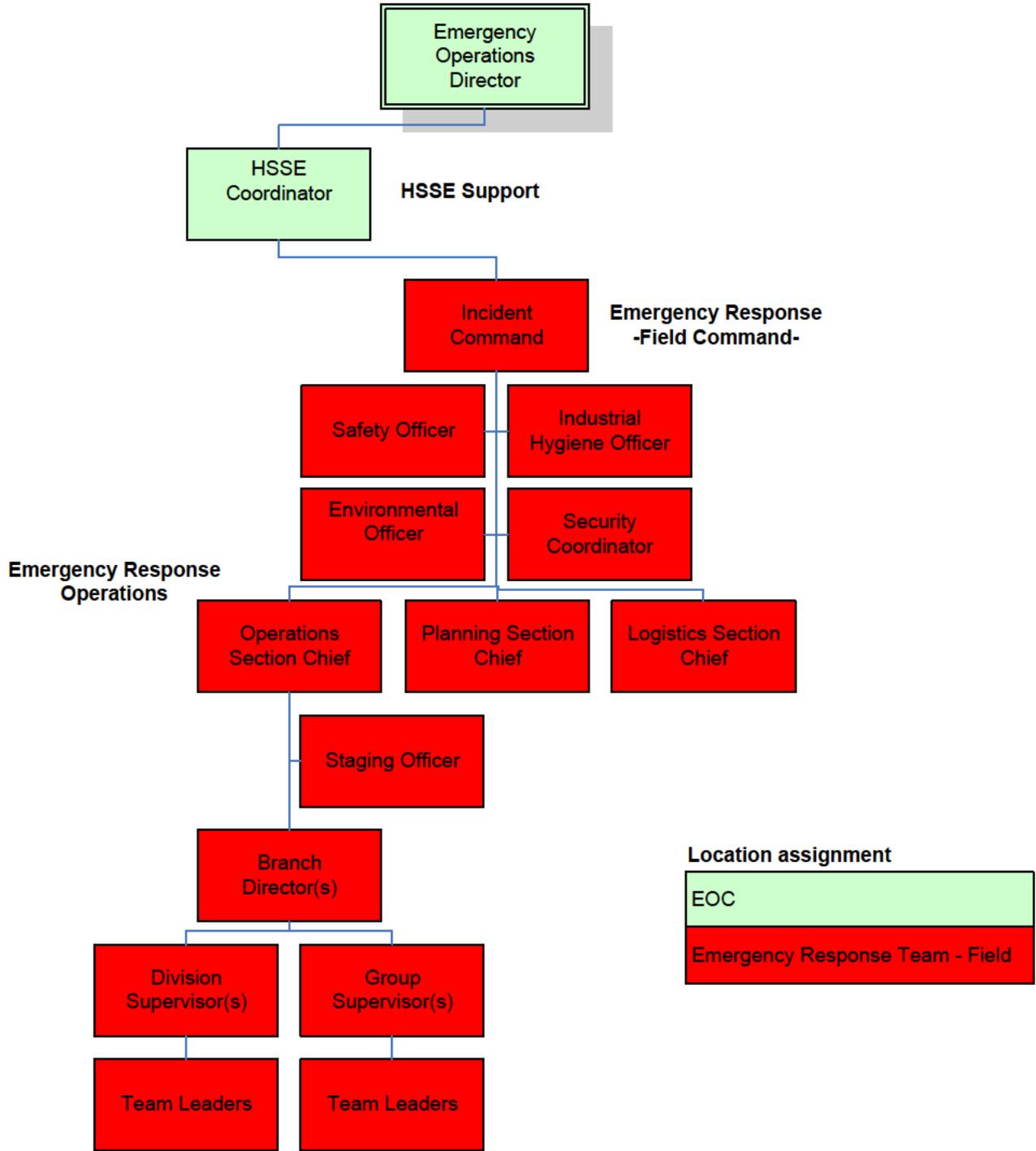
For further information see [Emergency Medical Services Plan HSE-EAP-010](#) and the [Rescue Response Plan HSE-EAP-011](#).

Rescue Group

When established, the Rescue Group Supervisor directs response efforts focused toward accomplishing safe and effective confined space and high angle rescue operations. The Rescue Group Supervisor position is established to supervise Rescue Team Leaders / rescue team personnel and coordinate activities with other functional areas in order to establish and maintain proper patient care.

DOCUMENT NO:	HSE-EAP-007	PAGE:	8 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

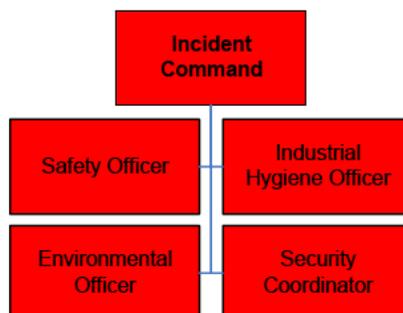
INCIDENT COMMAND SYSTEM ORGANIZATION



DOCUMENT NO:	HSE-EAP-007	PAGE:	9 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

ROLES & RESPONSIBILITIES

INCIDENT COMMAND



Assignment:	<ul style="list-style-type: none"> • Fire Chief
Alternate:	<ul style="list-style-type: none"> • Assistant Fire Chief • ERT Battalion Chief • ERT Senior Captain or Captain • Plant Shift Superintendent • Field Coordinator Qualified First Line Supervisor
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Reports to scene on all Alerts. Establishes Command. • Sets up Field Command Post as necessary.
Reporting:	<ul style="list-style-type: none"> • Reports to EOC HSE Coordinator.
Communications:	<ul style="list-style-type: none"> • Uses radio designation "Command". • Communicates on HSE-1 radio channel and by phone to HSE Coordinator in EOC. • Communicates with Plant Coordinator by phone. • Communicates with Field Coordinator directly. • Communicates with the Operations Section Chief on HSE-1 radio channel. • Communicates directly with Divisions or Groups if the Operations Section Chief is not established. • Communicates with staff officers on HSE-1 radio channel. • All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	10 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Incident Command
<ul style="list-style-type: none"> Exercises overall, on site direction and management of all Emergency Response Team efforts by defining strategic objectives, establishing priorities, and allocating resources.
<ul style="list-style-type: none"> Initiates and organizes the structure of the response receiving operational strategic direction from the Plan and Field Coordinators on response and process related concerns.
<ul style="list-style-type: none"> Initiates, maintains, and controls the communications process during the emergency.
<ul style="list-style-type: none"> Provides strategic plan to emergency response personnel. Command is Responsible for the provision and completion of tactical priorities. <p>Tactical priorities are:</p> <ul style="list-style-type: none"> Remove endangered occupants and treat injured. Stabilize the incident and provide for life safety. Conserve property. Provide for the safety, accountability and welfare of personnel (ongoing priority).
<ul style="list-style-type: none"> Develops and effective incident management organization.
<ul style="list-style-type: none"> Establishes formal Field Command Post (FCP) to coordinate field emergency operations.
<ul style="list-style-type: none"> Determines need for and issues orders for prompt evacuation of affected areas of the facility.
<ul style="list-style-type: none"> Plans for and ensures adequate staffing of emergency response team personnel in affected area.
<ul style="list-style-type: none"> Coordinates scene Industrial Hygiene, Security, Environmental, and Safety support efforts.
<ul style="list-style-type: none"> Works, in a unified manner, with the Field Coordinator to plan and implement response goals and objectives.
<ul style="list-style-type: none"> Supervises decisions on personal protective equipment requirements.
<ul style="list-style-type: none"> Reports information as necessary to the HSE Coordinator.
<ul style="list-style-type: none"> Ensures "Primary Search" is performed and personnel are accounted for in the affected area. Ensures "Secondary Search" is performed after the area is secured.

DOCUMENT NO:	HSE-EAP-007	PAGE:	11 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

<ul style="list-style-type: none">• Organizes and assigns emergency personnel consistent with the incident action plan.
<ul style="list-style-type: none">• Communicates incident response objectives and strategic goals to the Operations Section Chief.
<ul style="list-style-type: none">• Oversees overall safety of the ERT. Approves Site Safety Plan.
<ul style="list-style-type: none">• Requests and manages CIMA or other mutual aid resources.
<ul style="list-style-type: none">• Ensures site and scene control.
<ul style="list-style-type: none">• Assesses medical requirements and initiates medical response.

DOCUMENT NO:	HSE-EAP-007	PAGE:	12 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

SAFETY OFFICER



Assignment:	<ul style="list-style-type: none"> • Safety Officer qualified ERT Officer
Alternate:	<ul style="list-style-type: none"> • Safety Officer qualified ERT Member • Assigned Health & Safety Representative
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by Command at scene on all Alerts except for medical incidents as deemed not necessary
Reporting:	<ul style="list-style-type: none"> • Reports to Command
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel to Command. • Communicates with the Operations Section Chief, Branch Directors, Divisions, and Group Officers as necessary. • All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	13 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Safety Officer

- Monitors and evaluates safety hazards and related conditions during an emergency incident.
- Monitors emergency response efforts and advises Command on safety related problems and potential problems.
- Works with Industrial Hygiene Officer to complete and approve formal Site Safety Plan.
- Monitors and evaluates personal protective equipment used in regulated areas.
- Immediately stops any function, which involves imminent danger to personnel.
- When operating in a forward or otherwise hazardous location, must be attired in appropriate personnel Protective Equipment (PPE), including self-contained breathing apparatus (SCBA); have radio communication; and be accompanied by another ERT member.
- Ensures that regulated areas are defined, properly marked and complied with.
- The Safety Officer recommends any changes to the action plan as a result of on-going surveys.
- Monitors and evaluates decontamination processes and procedures.
- Conducts surveys to identify existing or potential hazards and informs Command of their findings.
- Recommends and requests the appointment by Command of Assistant Safety Officers as required by scene conditions.

DOCUMENT NO:	HSE-EAP-007	PAGE:	14 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

INDUSTRIAL HYGIENE OFFICER (IH OFFICER)



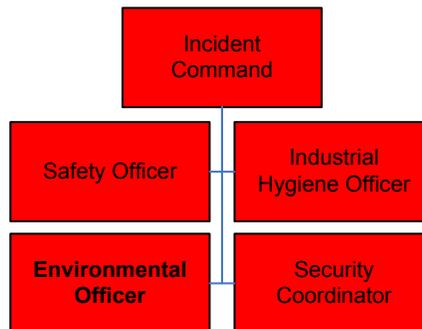
Assignment:	<ul style="list-style-type: none"> On-Call Health & Safety Representative
Alternate:	<ul style="list-style-type: none"> Assigned ERT member
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Responds to the Command Post on all alerts except for medical and rescue incidents.
Reporting:	<ul style="list-style-type: none"> Reports to Command
Communications:	<ul style="list-style-type: none"> Communicates on HSE-1 radio channel to Command. Communicates with other responding industrial hygienists, HSE Safety Representatives, the Operations Section Chief, Branch Directors, Division and Group Supervisors as necessary. All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	15 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Industrial Hygiene Officer
<ul style="list-style-type: none"> • Supports and coordinates overall health related matters.
<ul style="list-style-type: none"> • Coordinates on-scene industrial hygiene monitoring.
<ul style="list-style-type: none"> • Manages industrial hygiene resources.
<ul style="list-style-type: none"> • Works with Safety Officer in developing the Site Safety Plan.
<ul style="list-style-type: none"> • Documents health reporting and other matters.
<ul style="list-style-type: none"> • May be requested to provide resources for offsite monitoring.
<ul style="list-style-type: none"> • Provides technical support on product and refinery streams.
<ul style="list-style-type: none"> • Assists in product identification and coordinates outside technical assistance.
<ul style="list-style-type: none"> • When operating in a forward or otherwise hazardous location, must be attired in appropriate personnel Protective Equipment (PPE), including self-contained breathing apparatus (SCBA); have radio communication; and be accompanied by another ERT member.
<ul style="list-style-type: none"> • Provides site assessment and consultation on health exposures.
<ul style="list-style-type: none"> • Reports health assessments and monitoring data to the Incident Commander and the Operations Section Chief.
<ul style="list-style-type: none"> • Works with Safety Officer to establish regulated areas.
<ul style="list-style-type: none"> • Consults with Medical Officer on health and hygiene matters.
<ul style="list-style-type: none"> • Works with Hazmat Division to establish PPE requirements and assists with decon strategy.
<ul style="list-style-type: none"> • Obtains technical information on stock items purchased from manufacturers as necessary.
<ul style="list-style-type: none"> • Obtains MSDS information.
<ul style="list-style-type: none"> • Recommends any changes to the action plan as a result of on-going surveys.

DOCUMENT NO:	HSE-EAP-007	PAGE:	16 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

ENVIRONMENTAL OFFICER



Assignment:	<ul style="list-style-type: none"> On-Call Environmental Representative
Alternate:	<ul style="list-style-type: none"> Other assigned Environmental Representative
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Responds to the Field Command Post during all alerts except for Medical and Rescue Incidents.
Reporting:	<ul style="list-style-type: none"> Reports to Command.
Communications:	<ul style="list-style-type: none"> Communicates on HSE-1 radio channel and by phone to Environmental Support Unit in EOC. Communicates with other Environmental Engineers and HSE personnel as necessary. All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

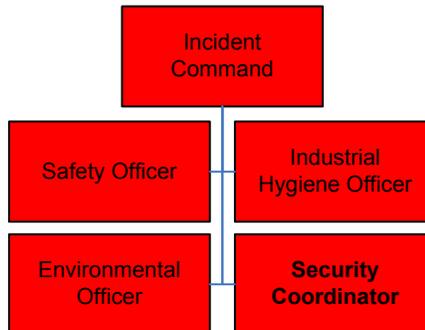
DOCUMENT NO:	HSE-EAP-007	PAGE:	17 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Environmental Officer

- Supports and coordinates on-scene and on-site environmentally related matters.
- Monitors on-scene conditions related to the emergency, which have environmental implications.
- Provides environmental assessment and consultation to affected area on exposure and controls.
- Ensures that environmental reporting is performed. Updates reporting as necessary.
- Assists in documenting environmental reporting and other matters.
- Works with Environmental Support Unit in EOC to ensure escorts are provided for responding environmental agencies.
- Manages on-scene environmental resources.
- Works with Environmental Support Unit in EOC on resource management for all environmental matters.
- Advises Command and the Field Coordinator on environmental matters.
- Coordinates attainment of any spill or release safety permits. Makes arrangements for sample analysis.

DOCUMENT NO:	HSE-EAP-007	PAGE:	18 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

SECURITY COORDINATOR



Assignment:	<ul style="list-style-type: none"> • Security Team Leader
Alternate:	<ul style="list-style-type: none"> • Assigned HSE Security Representative
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Responds directly to scene on any Alert. Immediately secures the affected area.
Reporting:	<ul style="list-style-type: none"> • Reports to Command.
Communications:	<ul style="list-style-type: none"> • Communicates with Command on HSE-1 radio channel. • Communicates with other responding Security Representatives. • All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

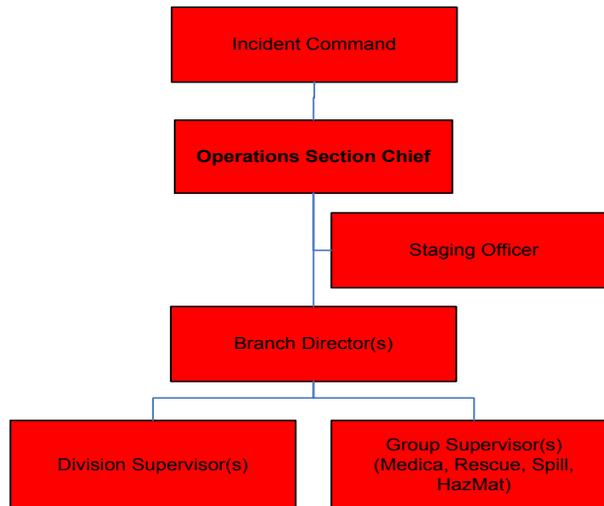
DOCUMENT NO:	HSE-EAP-007	PAGE:	19 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Security Coordinator

- Coordinates on-scene and site security related matters.
- Coordinates on-scene security and roadblock assistance. Controls access routes to incident area and routes traffic.
- Assists Command and the Security Support Unit in assessing on-site scene security needs.
- Assists in documenting security reporting and other matters.
- Works with the Staging Area Manager to establish escorts and directions for outside resources.
- Coordinates runners as necessary for Command.
- Ensures alternate EOC (HRO Training Center) is accessible if needed.
- Manages security resources on site.
- Ensures that on-scene security reporting is performed.
- Secures scene and evidence as requested.
- Assists Air Operations Officer in securing landing zone.
- Coordinates with Medical Officer to establish triage area.

DOCUMENT NO:	HSE-EAP-007	PAGE:	20 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

OPERATIONS SECTION CHIEF



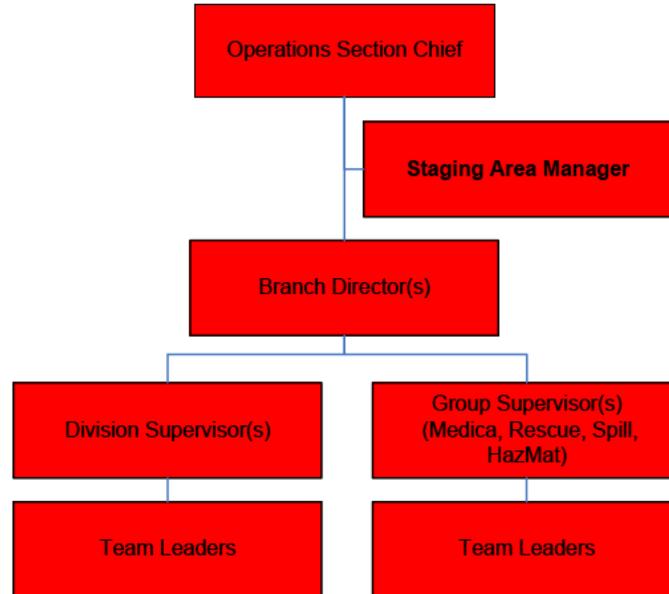
Assignment:	<ul style="list-style-type: none"> • Assistant Fire Chief
Alternate:	<ul style="list-style-type: none"> • Battalion Chief • Assigned Senior Captain or Captain • Assigned Lieutenant
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by Command as required.
Reporting:	<ul style="list-style-type: none"> • Reports to Command.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with Command. • Communicate directly with: <ul style="list-style-type: none"> ○ Divisions or Groups on HSE-1 radio channel. ○ Staging Area Manager on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	21 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Operations Section Chief
<ul style="list-style-type: none"> • When established, the Operations Section Chief is responsible for direct management of all incident Emergency Response Team (ERT) tactical activities.
<ul style="list-style-type: none"> • Obtains strategic goals and directions from Command.
<ul style="list-style-type: none"> • Translates strategic goals to tactical action plans.
<ul style="list-style-type: none"> • Oversees the control, coordination, and supervision of all branch, division, and group activities.
<ul style="list-style-type: none"> • Directs Branch Directors, Divisions and Groups in establishing fire lines and controlling hot zones.
<ul style="list-style-type: none"> • May establish Branch Directors, Divisions, and Groups as necessary.
<ul style="list-style-type: none"> • Initiates search and rescue activities to ensure accountability of personnel.
<ul style="list-style-type: none"> • Resolves high-level ERT logistics issues.
<ul style="list-style-type: none"> • Determines needs and requests additional resources.
<ul style="list-style-type: none"> • Provides reports to superior as required.
<ul style="list-style-type: none"> • Reports information on special activities, events, and occurrences as necessary to Command.
<ul style="list-style-type: none"> • Supervises deployment of resources, continually evaluates the response effort, and maintains communications with the field command post.
<ul style="list-style-type: none"> • Interacts with process operations personnel as required.
<ul style="list-style-type: none"> • Assigns task assignments in association with action plans.
<ul style="list-style-type: none"> • Communicates incident response strategic goals and tactical objectives to Branch Directors, Divisions, and Groups.

DOCUMENT NO:	HSE-EAP-007	PAGE:	22 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

STAGING AREA MANAGER



Assignment:	<ul style="list-style-type: none"> Assigned Senior Captain or Captain
Alternate:	<ul style="list-style-type: none"> Assigned ERT Member Assigned HSE Security Representative May be assigned to CIMA Emergency Response Specialist.
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Established for all Alerts. Responds to designated Staging area as required.
Reporting:	<ul style="list-style-type: none"> Reports to Command or if established, to the Operations Section Chief
Communications:	<ul style="list-style-type: none"> Communicates on HSE-1 radio channel to the Operations Section Chief. All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

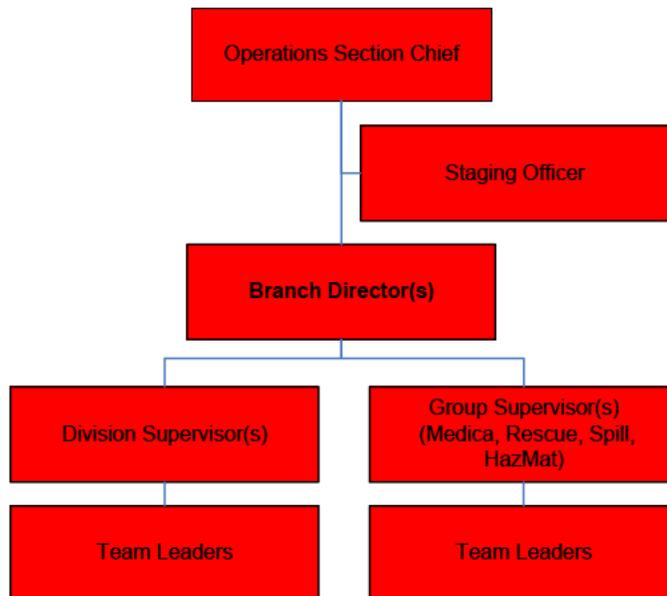
DOCUMENT NO:	HSE-EAP-007	PAGE:	23 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Staging Area Manager

- The Staging Area Manager coordinates all staging activities.
- Establishes all functions of staging outside resources.
- Keeps Command or the Operations Section Chief respectively informed of resource status.
- Documents all staged resources according to CIMA procedures. Maintains log of companies in staging area and keeps appropriate inventory of information.
- May be assigned to request resources.
- Assigns additional staging personnel as required to manage scene. Coordinates staging personnel activities
- Maintains records of ERT personnel responding.
- Coordinates operations of Cascade Unit
- Manages routing of resources to appropriate Divisions or Groups. Works with Security Coordinator to provide appropriate direction or escorts into facility.
- Ensures all apparatus are parked and organized in an appropriate manner.
- Assists Command in determining what level of staging to maintain (usually 50% of committed resources).
- Assist with management of Rehab supplies.

DOCUMENT NO:	HSE-EAP-007	PAGE:	24 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

BRANCH DIRECTOR



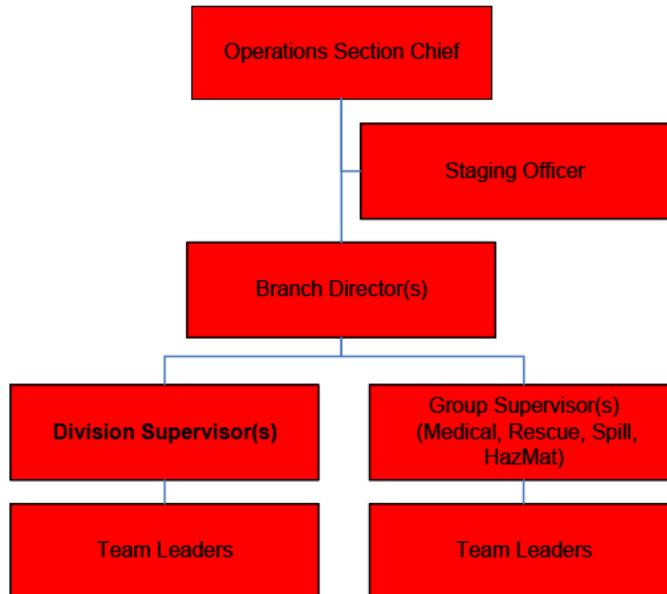
Assignment:	<ul style="list-style-type: none"> • Battalion Chief
Alternate:	<ul style="list-style-type: none"> • Assigned Senior Captain or Captain • Assigned Lieutenant
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by Command or the Operations Section Chief as required.
Reporting:	<ul style="list-style-type: none"> • Reports to the Operations Section Chief.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with the Operations Section Chief. • Communications with Divisions and Groups on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	25 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Branch Director(s)
<ul style="list-style-type: none"> When established, Branch Directors are responsible for management of Emergency Response Team (ERT) tactical activities in their designated area of responsibility. A Branch Directors area of responsibility may be defined geographically or functionally.
<ul style="list-style-type: none"> Obtains strategic goals and directions from the Operations Section Chief.
<ul style="list-style-type: none"> In their assigned area of responsibility, initiates search and rescue activities to ensure accountability of personnel.
<ul style="list-style-type: none"> Assigns tactical work tasks to Divisions and Groups.
<ul style="list-style-type: none"> May establish Divisions and Groups as necessary.
<ul style="list-style-type: none"> Oversees the control, coordination, and supervision of all Divisions and Groups under their direction.
<ul style="list-style-type: none"> Directs Divisions in establishing fire lines and controlling hot zones.
<ul style="list-style-type: none"> Supervises deployment of resources to Divisions or Groups, continually evaluating the status of tactical actions.
<ul style="list-style-type: none"> Reports information on special activities, events, and occurrences as necessary to the Operations Section Chief.
<ul style="list-style-type: none"> Interacts with process operations personnel as required.
<ul style="list-style-type: none"> Assigns task duties in association with action plans.
<ul style="list-style-type: none"> Communicates incident response tactical objectives to Divisions or Groups.
<ul style="list-style-type: none"> Resolves logistic problems.

DOCUMENT NO:	HSE-EAP-007	PAGE:	26 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

DIVISION SUPERVISOR(S) (Geographic)



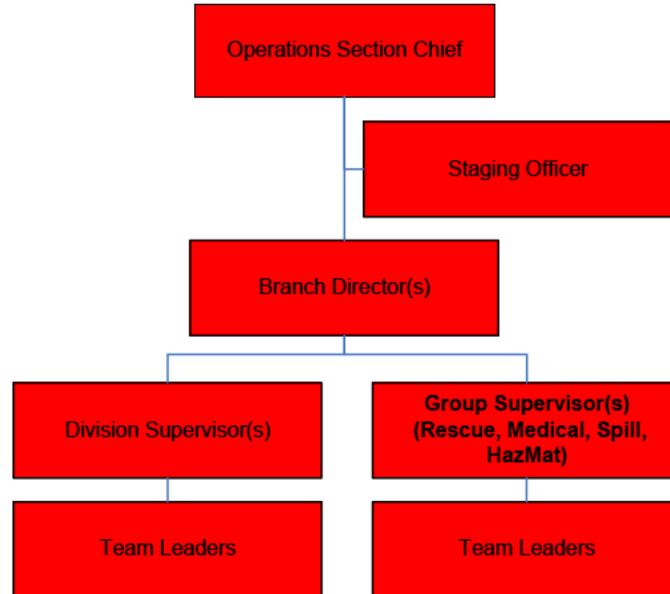
Assignment:	<ul style="list-style-type: none"> • Senior Captain
Alternate:	<ul style="list-style-type: none"> • Assigned Captain • Assigned Lieutenant • Assigned ERT member
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by the Operations Section Chief or Branch Director as required.
Reporting:	<ul style="list-style-type: none"> • If Branches are not established, reports to the Operations Section Chief • Reports to Branch Director when established.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with the Operations Section Chief, or if established Branch Director. • Communicates with other Divisions or Groups on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	27 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Division Supervisor(s)
<ul style="list-style-type: none"> • When established, Division Supervisors directs the response effort of Emergency Response Team (ERT) members in tactical divisions as assigned.
<ul style="list-style-type: none"> • Provides tactical action as directed in geographic area.
<ul style="list-style-type: none"> • Assigns task duties to ERT members.
<ul style="list-style-type: none"> • Directly supervises ERT members assigned to their respective division.
<ul style="list-style-type: none"> • Provides the tactical action plan to ERT Leaders and members.
<ul style="list-style-type: none"> • Determines and requests assistance and resources in order to perform assigned actions.
<ul style="list-style-type: none"> • Reports as necessary to superior.
<ul style="list-style-type: none"> • Interacts with process operations personnel as required.
<ul style="list-style-type: none"> • Coordinates activities with adjacent Divisions and Groups.
<ul style="list-style-type: none"> • Reports special occurrences or events, such as accidents or sickness, to superior.
<ul style="list-style-type: none"> • Participates in the development of branch tactical plans.

DOCUMENT NO:	HSE-EAP-007	PAGE:	28 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

GROUP SUPERVISOR(S)
(Medical, Rescue, Spill, Hazmat)



Assignment:	<ul style="list-style-type: none"> • Senior Captain
Alternate:	<ul style="list-style-type: none"> • Assigned Captain • Assigned Lieutenant • Assigned ERT member
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by the Operations Section Chief or Branch Director as required.
Reporting:	<ul style="list-style-type: none"> • If Branches are not established, reports to the Operations Section Chief • Reports to Branch Director when established.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with the Operations Section Chief, or if established Branch Director. • Communicates with other Divisions or Groups on HSE-1 radio channel. • Communicates with Boat Crew on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	29 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Group Supervisor (Medical, Rescue, Spill, Hazmat)
<ul style="list-style-type: none"> • When established, Group Supervisor directs ERT tactical efforts and actions relating to their functional assignment.
<ul style="list-style-type: none"> • Provides tactical action as directed in functional area.
<ul style="list-style-type: none"> • Provides the tactical action plan to ERT Leaders and members.
<ul style="list-style-type: none"> • Determines and requests resources in order to perform assigned actions.
<ul style="list-style-type: none"> • Provides action plan and reviews safety procedures with personnel.
<ul style="list-style-type: none"> • Supervises ERT members assigned to their respective group.
<ul style="list-style-type: none"> • Interacts with process operations personnel as required.
<ul style="list-style-type: none"> • Reports as necessary to Command / the Operations Section Chief / a Branch Director.
<ul style="list-style-type: none"> • Coordinates activities with adjacent Divisions and Groups.
<ul style="list-style-type: none"> • Reports special occurrences or events, such as accidents or sickness, to superior.
<ul style="list-style-type: none"> • Participates in the development of functional tactical plans.

DOCUMENT NO:	HSE-EAP-007	PAGE:	30 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required.
All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
05/09/2011	Jeff Windham	Reformat, reorganize and regulatory review of procedure	

Houston Refining LP	DOCUMENT NUMBER:	HSE-EAP-008	Page: 1 of 13	Approval Date:	06/30/2011
Document Title:	COMMUNICATIONS				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	05/10/2011	

Communications are a critical element of the emergency response and management effort. During emergencies communications must be immediate and accurate.

This Communications Plan provides information on the communications systems available to communicate to internal and external stakeholders during various emergency events.

EMERGENCY COMMUNICATIONS AND NOTIFICATION

Main Gate Dispatch is equipped with two-way radios, telephones, paging systems and a refinery Emergency Notifications System (ENS). The Dispatch Center is staffed 24 hours a day by a security representative trained for routine and emergency situations. Dispatchers also maintain a current telephone call-out list and the telephone numbers for all support agencies whose assistance might be needed during any type of emergency or incident. The ENS provides emergency and evacuation instructions to personnel throughout the facility. Consequently, the Main Gate is the focal point for emergency communications both inside and outside the refinery.

A secondary point for emergency communications is the Central Control Room (CCRB). The primary focus of the CCRB is communications with the process operating units during routine and emergency operations. The CCRB is equipped with radios, telephones, and a redundant Emergency Notification System (ENS) control console. These systems make the control room a fully functional secondary dispatch center.

Refinery Radio System

The refinery operates a trunked type radio system, which provides radio communication between personnel, vehicles, and key locations. A hub console, located at the Main Gate, can control all radio traffic for the entire system.

See [Appendix 5](#) for a list of radio system talkgroups

Radio Announcement System

The Radio Announcement System broadcasts a simultaneous message to every talkgroup channel on the radio system. The Announce System can be utilized for emergency and general plant announcements.

The Radio Announce System can be activated from the Main Gate Dispatch Console, and several specially programmed radios in the facility. Additionally, for emergencies, the Radio Announce System is integrated with the refinery Emergency Notification System (ENS).

NOTE: The Radio Announce System (activated from the Dispatch Radio Console) is the backup in the case of complete ENS failure.

DOCUMENT NO:	HSE-EAP-008	PAGE:	2 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

Radio Repeater Backup Systems

In the event of repeater failure the trunked radio system has two (2) backup modes available:

❑ Failsaft

During a partial system failure, radio talkgroups will be automatically pooled, or routed, onto three (3) repeaters by the system controller. This allows for limited radio communication. All users should limit communication to short messages that are absolutely necessary.

Users can recognize a failsaft condition by an audible soft tone heard on all radios every ten (10) seconds. Radios will indicate the condition by displaying the text "FAILSOFT" on the LCD screen every ten (10) seconds.

❑ Total Failure

A total radio system failure will be indicated by an audible soft tone heard on all radios every ten (10) seconds accompanied by the text "OUT OF RANGE" on the LCD screen every ten (10) seconds.

In the case of total system failure (repeater failure), Talkaround or Simplex Channels have been established for emergency communications. Talkaround channels do not utilize the trunked repeater system, thus allowing a fail-safe design that enables users to communicate "radio to radio" with limited range.

Talkaround channels are available and during a total system failure shall be allocated as indicated below:

Ops T/A 1	FCCU, Oil Movements
Ops T/A 2	Crudes, HDS, Light HDS
Ops T/A 3	Cokers
Ops T/A 4	SRU. Lubes
Maint T/A 1	South Maintenance
Maint T/A 2	North maintenance
ERT Tac 1	Primary HSSE and Emergency
ERT Tac 2	Secondary HSSE and Emergency
ERT Tac 3	Secondary HSSE and Emergency
ERT Tac 4	Secondary HSSE and Emergency
ERT Tac 5	Secondary HSSE and Emergency

DOCUMENT NO:	HSE-EAP-008	PAGE:	3 OF 15
DOCUMENT NAME: COMMUNICATIONS			

Backup Radio System

In addition to the talkaround channel plan, a backup radio system is available and may be placed in service. The backup radio system is a self-contained mobile radio system, which provides five (5) fully functional repeaters; four (4) of which are available for voice communication. With the backup system in service, normal radio system talkgroups can be used. This system cannot be used in conjunction with Talkaround channels. In the event this system is forced into service, users will be directed to return to their normally assigned talkgroups. Keeping communication to a minimum is imperative while using the backup system due to its limited number of repeaters and concurrent use by process units.

CIMA Emergency Scene Communications

(b) (7)(F), (b) (3)

Emergency Notification System ENS

The refinery Emergency Notification System (ENS) is used to advise personnel of emergency response and evacuation orders (See the [HSE-EAP-002 Emergency Notification and Response](#), and [HSE-EAP-003 Evacuation and Personnel Accounting Procedure](#)).

The ENS is an integrated multi-media system designed for the purpose of communicating emergency messages to plant occupants. The system consists of tone, voice, and text messaging to a combination of sub-systems throughout the facility.

The ENS may also be used to inform personnel of situations such as non-emergency incidents, severe weather conditions, or abnormal operational issues.

NOTE: the Main Gate Dispatcher conducts a full ENS test every Thursday at noon.

DOCUMENT NO:	HSE-EAP-008	PAGE:	4 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

ENS Components

ENS components can be described as follows:

ENS Media System Components	Type of Message and Location
Plant Radio Announce Talkgroup	Signal tone and voice message on all refinery radio system Talkgroups (Channels).
Building Public Address (PA) Systems	Signal tone and voice message on public address systems in buildings (Indoor public address sites).
Siren/Speaker Sites and Distributed Audio Systems	Signal tone, voice message, and signal strobe light from Plant/Siren Sites and Distributed Audio Speakers in operating area and units (Outdoor sites).
Message Signs	Text message signs located at refinery main entry points and gates.
Emergency Management Pager System	Text message sent to emergency management group pagers. Appendix 4 : lists the various emergency management pager groups.
Workstation PC Messaging	Pop-up text message sent to all LAN PC workstations.

The ENS components can be initiated by a single activation for Emergency Alerts, or may be set off individually for specific or special emergency notification or message requirements.

See [Appendix 1](#) for an illustration of the ENS architecture.

See [Appendix 2](#) for a description of the ENS component activation logic.

ENS Activation

Upon notification of an emergency, the Main Gate Dispatcher activates the ENS from the primary console. Emergency activation of the ENS will communicate emergency information by tone, voice and text message. Information provided will include Alert Level, Type of Emergency, Location, Wind Direction and Evacuation Type. Additionally, the system is used to advise of any further special information.

An All Clear is issued over the ENS to indicate that the emergency has been terminated.

DOCUMENT NO:	HSE-EAP-008	PAGE:	5 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

Backup ENS Capability

In the event of primary ENS console failure, three (3) fully capable backup consoles may activate the ENS from the following locations.

- ❑ Central Control Room (CCRB)

The CCRB console may also be used by Operations as a secondary means of communications to Operating Units or Areas.

- ❑ Command Van
- ❑ Maintenance Radio Shop at Site D

NOTE: The Radio Announce System (activated from the Dispatch Radio Console) is the backup in the case of complete ENS failure.

ENS Signal Tones

There are three signal tones generated by the ENS:

High Low Signal	Alert for fire, spill, gas release or other emergency / event requiring action by plant personnel
Steady Tone Signal	All Clear
Pulse Signal	All personnel plant-wide report to Evacuation Points

Unit Distributive Audio

Distributive Audio Systems provide unit specific communications with the placement of speakers throughout an area. The ENS System is directly linked to unit distributive audio where available. Distributive systems may also be directly linked to hazard detection systems in order to expediently warn personnel and evacuate a process unit. Process areas with Distributive Audio Systems are listed as follows:

- ❑ SRU 434
 - Includes units 433/434/435/437
 - System directly linked to H₂S detection systems.
- ❑ SRU 439
 - Includes units 439/440/441/442
 - System directly linked to H₂S detection systems.
- ❑ 636 Hydrotreater
- ❑ 736 Coker
- ❑ 737 Coker
- ❑ 537 Crude Still

DOCUMENT NO:	HSE-EAP-008	PAGE:	6 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

Emergency Management Pager System

Primary emergency notification to off-site emergency management / response personnel is conducted through the emergency management pager system. The pager system is a module of the Emergency Notification System. ENS Alert activation results in automatic activation of the pre-determined pager group(s). Manual activation of pager groups and individual pagers is accomplished by the Main Gate Dispatcher.

Emergency management pagers are established into three different cap code pager groups:

Alert 1 Pager Group Cap Code: 0399998	ERT Officers HSSE Personnel Security Personnel Refinery Leadership Team
Alert 2 + Pager Group: Cap Code: 0300103	ERT Members (non-officers) Other identified emergency management support personnel
ERT Pager Group Cap Code: 0399999	All ERT Members

See [Appendix 3](#) for a description of the pager group activation logic and examples of additional programmed pager groups.

Emergency Pager Backup Systems

Two (2) pager backup systems are available:

- Quickpage System

The Quickpage system is a portable system capable of initiating alphanumeric pages to Emergency Management groups.

- AutoDial System

An AutoDial telephone system is programmed to send numeric coded messages to Emergency Management groups. The numeric coding system consists of three groups of numbers. In sequence, the groups represent response classification, incident type and zone of incident. For details and examples see Appendix 2.

A numeric code message may also be sent from any phone.

See [Appendix 4](#) for a description of the numeric paging codes for emergency situations.

DOCUMENT NO:	HSE-EAP-008	PAGE:	7 OF 15
DOCUMENT NAME: COMMUNICATIONS			

TELEPHONE SYSTEMS

The facility telephone and cellular phone systems provide a key means of communication with both internal and external stakeholders. Utilization of telephone and cellular lines during an emergency assists in keeping radio frequencies open for emergency radio traffic.

In the event of power failure, the plant telephone system is provided with emergency power. The system will shift back to normal power upon system restoration.

Various Telephone Lists to include the refinery phone system, fax machines, EOC phones, CCRB phones, Command Van cell phones numbers, outside line phone numbers and the Emergency network System phone numbers are accessible from the [EOC Website](#).

Outside Telephone Lines

In the event of a total telephone system failure, EOC is provided with six (6) outside telephone lines that are independent of the plant telephone system. These phones are labeled as "Outside Line".

Emergency Network System

As an additional backup and in the event local telephone service is overloaded, telephones attached to the Deer Park Emergency Network System may be used. These phones are located in EOC and are labeled as "Emergency Network System". The emergency Network System phone numbers and locations are available on the [EOC Website](#).

Emergency Notification Manual

The Emergency Management Database contains a telephone number listing of entities that may need to be contacted to provide assistance, or otherwise be notified in the event of an emergency.

In case of information system failure, hardcopy *Emergency Notification Manuals* are provided in the following locations:

- MainGate Dispatch
- Emergency Operations Center (EOC)
- Field Command Post
- Plant Shift Superintendents Office.

DOCUMENT NO:	HSE-EAP-008	PAGE:	8 OF 15
DOCUMENT NAME: COMMUNICATIONS			

EMPLOYEE COMMUNICATIONS

Refinery Emergency Information Line

Additionally, the Refinery Emergency Information Line provides employees and their families an opportunity to call and receive updated information during emergencies or abnormal situations such as weather events. To hear messages on the Emergency Information Line, call:

(713) 321-5775

LyondellBasell Information Line

In the event local phone service is not available, employees and their families may call the LyondellBasell Information Line to obtain emergency or abnormal situation updates. To access the LyondellBasell Information Line, call :

1 (888) 457-6118

- Press 2 and then 6 to access HRO, then
- Press 1 to hear an update on plant status
- Press 2 to leave your contact information / location
- Press 3 to leave a message or ask a question and receive a return call

www.hrohome.com

The Internet website www.hrohome.com has been established as a mechanism for two-way, interactive communication between refinery management and employees. Although primarily established for hurricane evacuation situations, hrohome.com may be activated for other types of abnormal situations. To access the website:

- go to www.hrohome.com from any Internet capable device
- Login with your normal Network Logon ID
- Utilize the last four digits of the SSN as the Password

General information including site status and return to work requirements are provided in the Site Status tab at the top of the page.

Employees can provide information on their status, location and contact information via the Adverse Condition Reporting tab at the top of the page.

hrocheckin@lyondellbasell.com

As a last resort in the event employees are unable to contact their supervisor or another refinery contact person, employees may send an email or text message with their personal status and location, or a location a question or concern to hrocheckin@lyondellbasell.com.

DOCUMENT NO:	HSE-EAP-008	PAGE:	9 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

(b) (7)(F), (b) (3)

DOCUMENT NO:	HSE-EAP-008	PAGE:	10 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

(b) (7)(F), (b) (3)

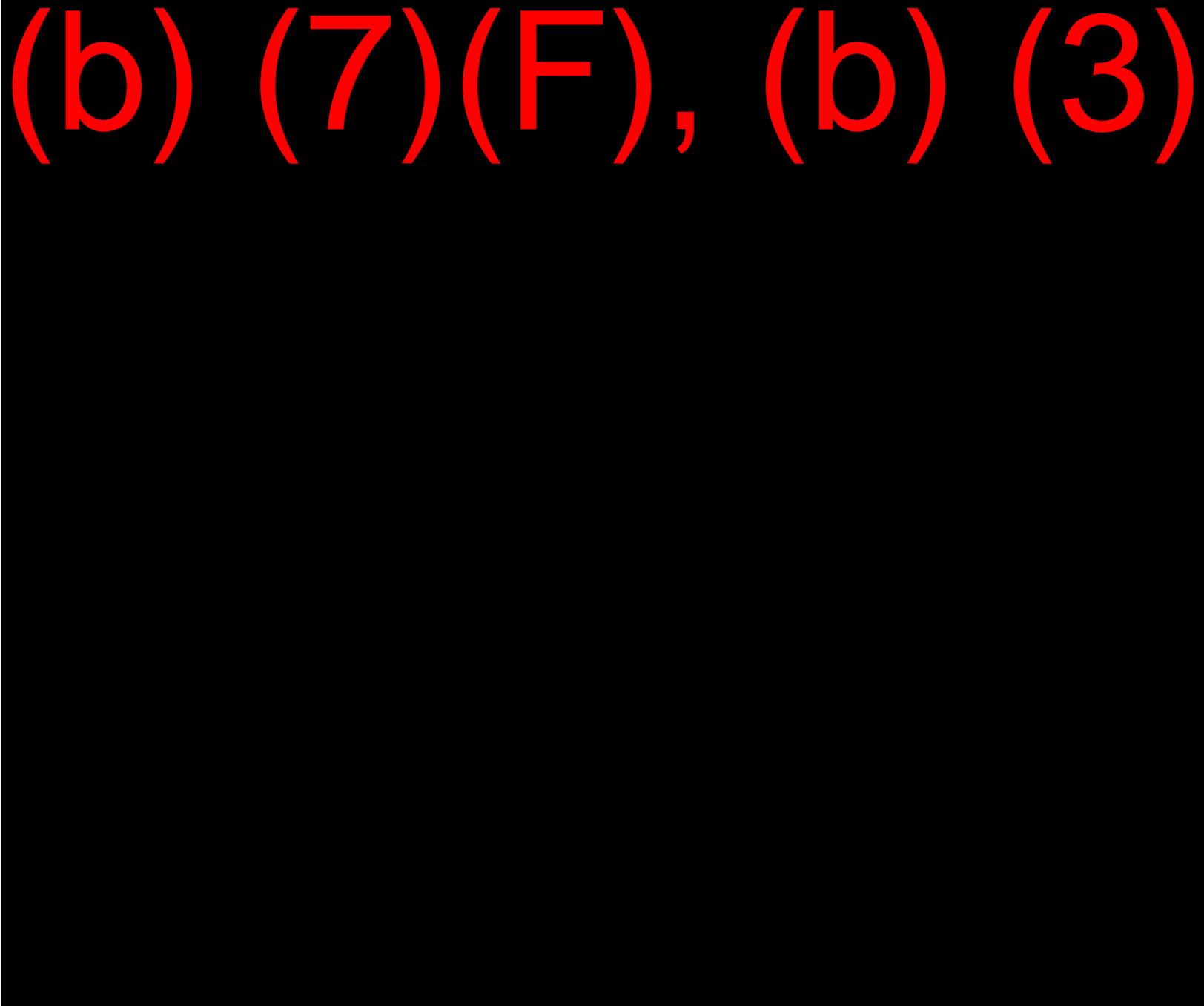
DOCUMENT NO:	HSE-EAP-008	PAGE:	11 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

(b) (7)(F), (b) (3)

DOCUMENT NO:	HSE-EAP-008	PAGE:	12 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

APPENDIX 4:

(b) (7)(F), (b) (3)

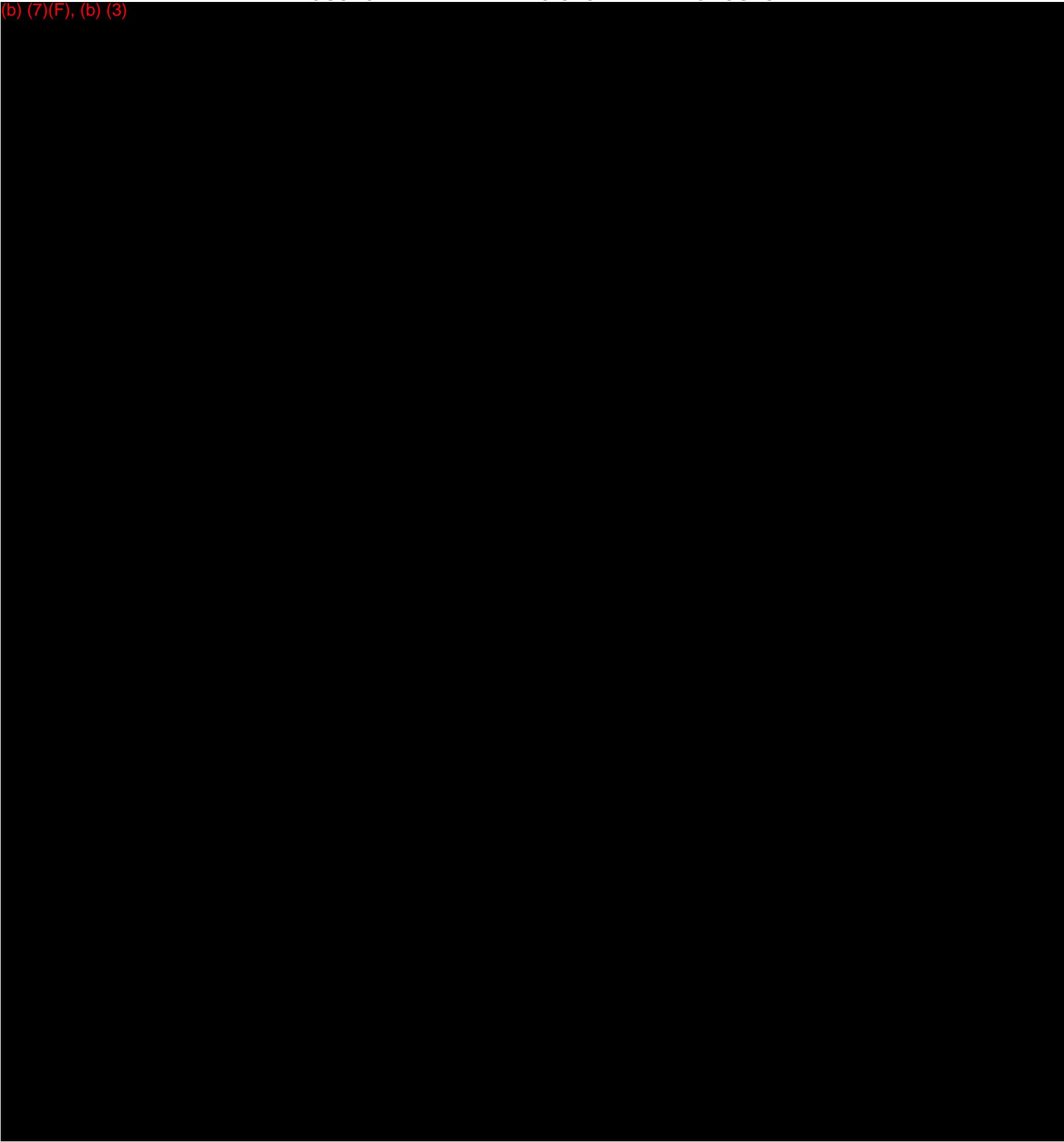


DOCUMENT NO:	HSE-EAP-008	PAGE:	13 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

APPENDIX 5

HOUSTON REFINERY RADIO SYSTEM TALKGROUPS

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-008	PAGE:	14 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

TURNAROUND2	Turn Around Channel
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FACILITIES	Facilities
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DOCUMENT NO:	HSE-EAP-008	PAGE:	15 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-010	Page: 1 OF 32	Approval Date:	06/30/2011
Document Title:	OUTSIDE RESOURCES AND MUTUAL AID				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

TABLE OF CONTENTS

Summary	2
Procedure	2
CIMA	2
Local Fire Departments	11
Emergency Medical and Rescue Services	14
Law Enforcement	17
Staging Areas and Landing Zones	20
Railroad Traffic Control	27
Appendix 1	28
Appendix 2	29
Appendix 3	30
Appendix 4	31
Revision Summary	32

DOCUMENT NO:	HSE-EAP-014	PAGE:	2 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

SUMMARY

The following describes procedures for the request and management of outside or mutual aid resources for emergencies. Additionally, the plan provides procedures for refinery responses to mutual aid requests (requests for refinery emergency resources).

CIMA Mutual aid resources are activated during Alert 4 Emergencies. However, limited requests for outside support may be made without the issuance of an Alert 4.

The Houston Refinery is located in the City of Houston. However, it is bordered on the east side by the City of Pasadena. Therefore, a multi-city response is possible dependent on the location and significance of the incident.

Due to the refinery being located in the City of Houston, the Houston Fire Department may be notified and requested to respond during an Alert 2 or greater event. This notice does not constitute an Alert 4 condition.

For a complete list of contact numbers see the Emergency Notification Manual.

CHANNEL INDUSTRIES MUTUAL AID (CIMA)

The Channel Industries Mutual Aid (CIMA) organization is an emergency response mutual aid group. The organization represents the joining together of over one hundred Houston Ship Channel area industries, government agencies and municipalities for the purpose of providing firefighting, rescue and emergency medical assistance for emergency situations -- either natural or man-made.

CIMA Zones

CIMA is divided into four (4) geographic zones:

- Zone 1 - All areas north of the Houston Ship Channel and the northern shore of Galveston Bay.
- Zone 2 - Area south of the Houston Ship Channel, west to downtown Houston, east to Beltway 8 and all areas south of the above mentioned boundaries.
- Zone 3 - Area south of the Houston Ship Channel and east of Beltway 8, south to Spencer Highway and east to the City of La Porte west city limits.
- Zone 4 - Area south of Spencer Highway, west to Beltway 8, east to the Galveston Bay Shores of the cities of Morgan's Point, La Porte, Shoreacres, Pasadena and Seabrook, and south to Interstate 45.

THE HOUSTON REFINERY IS LOCATED IN ZONE 2

DOCUMENT NO:	HSE-EAP-014	PAGE:	3 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Classifications of CIMA Emergencies

Fires or emergencies of different magnitudes are roughly classified below under the call designation which will be used on the CIMA Radio System. Members must understand the classifications of emergencies and the operations of the Zone system, and have planned for emergencies so the proper calls can be made in each instance.

Special Call

This call is issued in the form of a request for specific pieces of equipment, or manpower crews not to exceed a total of 2 pieces of equipment / crews. A Special Call also results in the response of one CIMA Officer, but DOES NOT automatically activate the CIMA Specialists and Command Van response.

Standby

A CIMA Standby is for an emergency event that is currently being managed with in-plant manpower and equipment, but which has the potential to develop into a larger emergency requiring outside assistance. This call activates the CIMA Specialists, Officer's and Command Van response.

Alarm List Activation

Alarm list activation is used for a fire or emergency which is beyond the control of in-plant manpower and materials to the extent that specific assistance is needed from members in the form of materials, equipment and/or manpower. The stricken company/agency activates a predetermined Alarm List. This call also activates the CIMA Specialists and Command Van response.

- 1st. Alarm Assignment
- 2nd. Alarm Assignment
- 3rd. Alarm Assignment
- MCI 10
- MCI 20
- MCI 30

DOCUMENT NO:	HSE-EAP-014	PAGE:	4 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

All Clear

The “all clear” will be given by the member who issued one of the above calls when the particular emergency condition which promoted the original call no longer exists.

CAER Alert

CIMA members, for expediency in making CAER notifications to neighboring CIMA facilities, may choose to use the CIMA radio system. However, it must be noted that the issuance of a CAER Alert over the CIMA radio system (regardless of the level), is for awareness only and does not constitute a CIMA Alert of any type. No response of the CIMA organization, including CIMA Specialist, is appropriate for a CAER Alert.

Road Block

Several CIMA members have made arrangements with adjacent facilities that upon notification, roads can be quickly blocked by personnel from those facilities until law enforcement can respond. This request can also be made on the CIMA radio system and DOES NOT, in and of itself, constitute a CIMA call of any type.

CIMA Alarm List

CIMA Alarm Lists provide a predetermined response catalogue for CIMA assistance to process events, tank fires, large volume water supply and EMS Mass Casualty (MCI) incidents.

Events that do not cleanly fit into one of the categories above will typically result in assignment of a process fire alarm list response.

The various CIMA Alarm Lists for Houston Refining can be accessed via the CIMA Database on the CIMA Website.

CIMA Radio System

CIMA owns and manages a radio system used by its members for dispatching and communicating. The refinery uses the CIMA radio system for requesting assistance and managing mutual aid responses in the facility. For further information on the CIMA Radio System, see [HSE-EAP-0008 Communications](#).

CIMA Dispatch

CIMA maintains two (2) dispatch centers operated 24-hrs a day in order to provide coverage for CIMA members during emergencies. CIMA dispatch is designated to dispatch Standbys, First Alarm Assistance, and Mass Casualty (MCI) calls.

The primary dispatch center for the Houston Refinery is CIMA Dispatch Baytown. CIMA Dispatch Baytown should be contacted to request a CIMA response to refinery events.

DOCUMENT NO:	HSE-EAP-014	PAGE:	5 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

CIMA DISPATCH CENTERS	
Location:	Contact number:
CIMA Dispatch Baytown	(713) 837-9191 or CIMA Radio System Channel C1 - Main Dispatch
CIMA Dispatch Pasadena	(713) 473-9191 or CIMA Radio System Channel C1 - Main Dispatch

*** Primary Dispatch Center for Houston Refinery***

Refinery CIMA Representative

A CIMA Representative must be designated for each member facility. The CIMA Representative for a member company is the official contact and voting member representing the organization.

The CIMA Representative and alternates for the refinery are as follows:

- Primary: Fire Chief
- First Alternate: Emergency Management Coordinator
- Second Alternate: Assistant Fire Chief, or designated ERT Officer

CIMA Emergency Response Specialist

CIMA Emergency Response Specialists are designated emergency responders in the organization who immediately report to any Standby or Assistance call for the purpose of supporting the stricken company with managing CIMA resources.

CIMA Assistance Procedures (Request for Assistance)

The Houston Refinery may require CIMA assistance for major emergencies requiring additional manpower and equipment support (Refinery Alert 4 response classification). Limited request for assistance (e.g., Houston Fire Department Emergency Medical Ambulance support), or a CIMA Special Call (request for not more than two (2) CIMA apparatus), may not constitute the issuance of a refinery Alert 4.

The following procedures outline the process for requesting and managing CIMA resources in the refinery.

DOCUMENT NO:	HSE-EAP-014	PAGE:	6 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

Authorization for the Request of CIMA Assistance

Any standby or assistance request to CIMA may be authorized by the following personnel:

- Emergency Operations Director
- EOC HSE Coordinator
- Incident Command
- Field Coordinator

Special Call or Alarm List Activation

The Main Gate Dispatcher may be requested to make the initial call. However, most assistance calls will be issued directly from the field command post. All subsequent communications with CIMA will be made by Incident Command.

Procedures for activation are as follows:

- Request for Standby or Assistance call shall be made via phone or over the CIMA Radio System to **CIMA Dispatch Baytown**. The preferable method is by the CIMA Radio System.
- Requests may include, but not be limited to the following:
 - ⇒ Request for Special Call (equipment or manpower)
 - ⇒ Request for Standby
 - ⇒ Request for Alarm List Activation
 - ⇒ Request for CIMA Mass Casualty Incident Response

Managing CIMA Resources

The following steps are to be used for managing CIMA resources entering the facility:

Note: Security will follow applicable Security Procedures when checking CIMA resources into the physical boundaries of the refinery to ensure compliance with TWIC requirements

- Incident Command shall designate which staging area will be used and assign a Staging Area Manager from Houston Refining.
- On arrival and assignment of CIMA resources into operational positions, Incident Command **shall give direction to move all emergency response radio traffic to the appropriate CIMA tactical channel talk group.**
- The Staging Area Manager will work with the EOC Security Coordinator to formulate plans for attaining plant resources required to escort CIMA resources from Staging to the respective assignment. The Staging Area Manager will document all incoming CIMA resources and shall track their assignment on the Staging Log.

DOCUMENT NO:	HSE-EAP-014	PAGE:	7 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- The first CIMA Specialist arriving at the facility will be escorted to Incident Command at the Field Command Post.
 - The second arriving CIMA Specialist will typically be assigned to Staging.
 - Incident Command may request that additional CIMA resources be dispatched by a CIMA Specialist designated as CIMA Dispatch.
 - All other CIMA Specialists will report to the Staging Area for assignment. CIMA Specialists will typically be assigned as follows:
 - ⇒ Field Command Post – CIMA Incident Command Liaison
 - ⇒ Staging Area Manager
 - ⇒ Operations Section Chief
 - ⇒ Planning Section Chief
 - ⇒ Division / Group Supervisor(s)
- CIMA Specialists will often be assigned to Houston Refining Emergency Response Officers to assist and liaison with CIMA resources.
- An All Clear for the CIMA request shall be given by Incident Command after all CIMA resources have been decommissioned and returned to service.

CIMA Assistance Procedures -- Rendering Mutual Aid

The Houston Refinery is listed on many CIMA member company and municipal agency alarm lists. The following procedure shall be followed to allow for a prompt assistance call response.

CIMA Standbys and Alerts will be received primarily over the CIMA Radio System. Main Gate Dispatch is responsible for monitoring the CIMA radio on a 24-hr basis and notifying the appropriate personnel as stated in this procedure. Main Gate Dispatch will maintain a current catalogue of member company alarm lists which include Houston Refinery resources.

Personnel Authorized To Release Resources for CIMA

The listed personnel are authorized to release refinery resources for CIMA Assistance Calls.

- Plant Shift Superintendent
- Refinery RLT Member
- Fire Chief
- Assistant Fire Chief
- Emergency Management Coordinator

DOCUMENT NO:	HSE-EAP-014	PAGE:	8 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

CIMA Standby

- On receipt of a CIMA Standby for any zone, the Main Gate Dispatcher shall notify:
 - ⇒ the ERT Officers
 - ⇒ ERT Members on-site
 - ⇒ the Plant Shift Superintendent

These notifications should be made via:

- ⇒ the Emergency Management Pager System, and
- ⇒ the Announce Frequency of the Radio Notification System
- ⇒ Telephone

These notifications shall include as much of the following information as is available:

- ⇒ Stricken facilities name
 - ⇒ Address
 - ⇒ Zone number
 - ⇒ Type of incident (if available)
 - ⇒ Other applicable information (i.e., Houston Refining is on the 1st Alarm)
- Refinery CIMA Specialist(s) shall respond directly to the stricken facility according to CIMA response procedures.
 - The Shift Commander on duty will assemble a standby crew when:
 - ⇒ The Standby is issued for Zone 2.
 - ⇒ A Standby is issued for a member company which lists refinery resources on their first or second alarms.
 - ⇒ A significant event exists that will most surely involve a refinery response.
 - The standby crew should pick up the requested equipment and assemble at the facility Main Gate

*The Officer in charge of the crew should be the ranking Officer from the respective discipline or equipment requested. *Example: Foam Engine 3, Sr. Captain - Fire Suppression; Hazmat Unit, Sr. Captain - Hazmat.* Ranking Officers may assign or take charge of respective crews.
 - The Standby Crew shall remain at the facility Main Gate until called to respond, released, or an All Clear is issued.

DOCUMENT NO:	HSE-EAP-014	PAGE:	9 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

CIMA Special Call or Alarm List Activation

The following procedures shall be followed when a request for refinery resources is received:

- On receipt of a CIMA request for assistance, the Main Gate Dispatcher shall notify:
 - ⇒ The ERT Officer's
 - ⇒ ERT Members on-site
 - ⇒ The Plant Shift Superintendent

These notifications should be made via

- ⇒ The Emergency Management Pager System
- ⇒ The Announce Frequency of the Radio Notification System
- ⇒ Telephone

These notifications shall include as much of the following information as is available:

- ⇒ Stricken facility's name
 - ⇒ Address
 - ⇒ Zone number
 - ⇒ Type of incident (if available)
 - ⇒ Refinery resources being requested
 - ⇒ Other applicable information (i.e., Shell has issued a 1st Alarm, and Houston Refining is one the 2nd Alarm)
- Refinery CIMA Specialist(s) shall respond directly to the stricken facility according to CIMA response procedures.
 - The Shift Commander on duty will assemble a response or standby crew as appropriate when:
 - ⇒ Refinery resources are requested to respond.
 - ⇒ Refinery resources are listed on the next Alarm level
 - ⇒ A significant emergency exists that will most surely involve a refinery response.

*The Officer in charge of the crew should be the ranking Officer from the respective discipline or equipment requested. *Example: Foam Engine 3, Sr. Captain - Fire Suppression; Hazmat Unit, Sr. Captain - Hazmat.* Ranking Officers may assign or take charge of respective crews.

Response Procedures

The following procedures shall be followed when responding to a CIMA Assistance Call:

- The CIMA Crew Officer will be responsible for:

DOCUMENT NO:	HSE-EAP-014	PAGE:	10 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- ⇒ Providing crew leadership and supervision.
 - ⇒ All equipment and resources used at the scene.
 - ⇒ Crew safety and health.
 - ⇒ All radio communications with CIMA units and the Main Gate Dispatcher.
 - ⇒ On scene communications with CIMA tactical officers.
- If multiple apparatus are requested to respond in the *Off Hours*:
 - ⇒ The most necessary apparatus will be responded first by ERT Members on-site.
 - ⇒ Additional apparatus or equipment will be staffed by off-site ERT members.
 - The Plant Shift Superintendent **must** be notified when equipment leaves the facility.
 - In accordance with CIMA standard operating procedures:
 - ⇒ All response personnel must have full turnout gear and SCBA. The exception is personnel responding to an EMS assistance call on Medic 1.
 - ⇒ A minimum crew of four (4) personnel is required on an apparatus. A minimum crew of two (2) personnel is required on Medic 1.
 - ⇒ Responding personnel must have CIMA radio communications. The CIMA patch may be utilized as necessary. (See **Communications.**)
 - ⇒ Responding resources shall announce their response over CIMA Channel C1 (i.e., "Lyondell Houston Aerial 1 Responding")
 - For some responses, it may be necessary to respond with a support vehicle with appropriate state required emergency warning devices.
 - All response procedures as stated in CIMA standard operating procedures will be followed.

Other Considerations

- The refinery status must always be considered when responding to outside emergencies. **The refinery must be adequately protected.**

In certain instances, it may be prudent to advise another CIMA member facility to place a crew on standby to assist in plant protection while refinery special equipment and personnel are committed.
- If a refinery Alert is issued while refinery resources are committed to a CIMA Assistance Call, the Team Leader and Refinery CIMA Response Specialists shall evaluate the Alert and request a release from the outside scene as deemed necessary.

DOCUMENT NO:	HSE-EAP-014	PAGE:	11 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- Most requests for refinery resources will be for a single apparatus and crew only. However, a significant disaster may require a second team and further apparatus to respond. The Houston Refinery is on several member companies' alarm lists with a request for multiple apparatuses.
- Consideration must always be given to properly relieving crews for long duration events. The Shift commander on duty will coordinate assignment of relief crews.

CIMA Member Companies and Agencies

Names, telephone numbers, alarm lists, and equipment lists for CIMA members are listed in the **CIMA DATABASE on the CIMA WEBSITE**.

For further details concerning CIMA procedures and resource lists see the CIMA WEBSITE.

FIRE PROTECTION: LOCAL FIRE DEPARTMENTS

Although they are members of CIMA, two municipal fire fighting organizations and the Houston Port Authority are available to assist with facility fire protection.

For CIMA fire protection capabilities see **Channel Industries Mutual Aid**.

Houston Fire Department

The Houston Fire Department (HFD) has primary fire suppression jurisdiction for the Houston Refinery.

At Incident Command's discretion, HFD may be notified and requested to respond during the activation of an Alert 2 incident. HFD will automatically be called for an Alert 3 or greater – Fire, Spill, or Gas Release.

The Houston Fire Department will also be contacted for emergency medical services (EMS). See **Emergency Medical Services Plan**.

Houston Fire Department Procedures

- The first arriving or HFD Command Officer and his respective unit (District Chief, Captain, or apparatus officer) shall be escorted directly to Incident Command at the Command Post.
- All other apparatus shall be instructed to stage on Lawndale (Initial Staging Area) until instructed to move up to an in-plant Staging Area (CIMA Staging Area). ER - Command may assign a Houston Refining Staging Area Manager to organize the staging effort (see Staging Officer).
- Per HFD Command's request, a liaison through the Houston Fire Department's Hazardous Materials Response Team (HM-22) may be organized.

DOCUMENT NO:	HSE-EAP-014	PAGE:	12 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- HFD resources shall be utilized by Command as deemed necessary. Additional resources may be requested.
- A unified command structure may be organized as necessary.
- An HFD Officer will be requested to stay at the Command Post until the event is under control.

Pasadena Fire Department

With the exception of the (b) (7)(F), (b) (3) [REDACTED], the refinery is not in the immediate jurisdiction of the Pasadena Fire Department (PFD). However, refinery emergencies may affect the City of Pasadena or PFD may be responding due to a citizen report.

Pasadena Fire Department Procedures

- The first arriving or PFD Command Officer and his respective unit (District Chief, Captain, or apparatus officer) shall be escorted directly to Incident Command at the Command Post.
- All other apparatus shall be instructed to stage on Lawndale (Initial Staging Area) until instructed to move up to an in-plant Staging Area (CIMA Staging Area). Command may assign a Houston Refining Staging Area Manager to organize the staging effort (see Staging Officer).
- The PFD Command Officer will be informed concerning the emergency. If the event impacts the City of Pasadena, the officer will be requested to stay at the Command Post until the event is under control. PFD resources may be requested by Command as deemed necessary. Additional resources may be requested.
- A unified command structure may be organized as necessary.

Houston Port Authority Fire Department

The Houston Port Authority Fire Department operates three (3) Fire Boats on the Houston Ship Channel. The Port Authority has jurisdiction on the Houston Ship Channel shoreline with boundaries from the turning basin to the Bayport Channel. These Fire Boats are available for waterfront and ship / barge firefighting support. The fire boats also have the capabilities of supplying water to the refinery fire water system.

Fire Boat assistance may be requested through the:

- **Port Authority Dispatch (713) 670-2647(primary number)**
- CIMA Dispatch, CIMA Channel C1 - Dispatch
- Houston Fire Department Dispatch.

DOCUMENT NO:	HSE-EAP-014	PAGE:	13 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Fire Boat Procedures for Ship or Dock Fire

- Responding Fire Boats will monitor CIMA Channel C1 - Dispatch.
- In route, the Fire Boats shall be advised at which dock the emergency is located and all hazards involved.
- When the Fire Boat arrives, a Houston Refinery ERT Officer shall be placed on the vessel as soon as practical. This will allow enhanced radio communications with Incident Command.
- If possible, a senior Officer with the Port Authority shall be requested to stay at the Command Post until the event is under control.
- A unified command structure may be organized as necessary.

NOTE: Fire protection for ship and barge fires is not the direct responsibility of Houston Refinery. The Houston Refinery may support vessel fire efforts and will initiate action necessary to protect the Houston Refinery dock and shoreline facilities.

Fire Boat Procedures for Water Supply

- Responding Fire Boats will monitor CIMA Channel C1 - Dispatch.
- In route, the Fire Boats shall be advised at which dock to report.
- When the Fire Boat arrives, a Houston Refinery ERT Officer shall meet the vessel at the docks and assist in supply line connection and for communication with Incident Command.
- 5" Storz supply lines shall be used if possible. 2.5" NST supply lines may be used, but are not preferred. Enough supply lines shall be set up to provide for full pumping capacity of the Fire Boat. An in-line bleeder should be used to evacuate supply lines when removing them from service.
- Water flow should be opened and closed slowly to prevent piping damage to boats and associated refinery equipment.
- If Fire Boat master streams are utilized, adjacent electrical equipment shall be isolated.
- Rehabilitation for Fire Boat Crews should be considered.

DOCUMENT NO:	HSE-EAP-014	PAGE:	14 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

EMERGENCY MEDICAL AND RESCUE SERVICES

Emergency Medical Services (EMS) are available from the Houston Fire Department and Memorial-Hermann Hospital Lifelight (Medivac). CIMA resources are available for mass casualty events.

For CIMA Mass Casualty Incident Plan management and available Rescue Resources, see the **CIMA WEBSITE**.

Houston Fire Department Emergency Medical and Rescue Services

The Houston Fire Department (HFD) has secondary EMS and Rescue duty responsibilities for the Houston Refinery.

The Houston Fire Department will be contacted for emergency medical services (EMS) requiring transportation by outside ambulance to area hospitals.

The HFD EMS Division responds (dispatches units) on a tiered system dependent on the type of emergency. Therefore, the type of assistance received is directly related to patient information provided to the HFD Dispatcher.

HFD EMS and Rescue responses may include but not be limited to the following:

- Ambulance -- Basic Life Support (BLS) Unit
- Medic Unit -- Advanced Life Support (ALS) Unit
- Engine Company -- Engine Company dispatched as first responder or to assist Medic Unit on life-threatening incidents, i.e., CPR in progress.
- Ladder Company -- Ladder trucks provide first responder and light rescue capabilities, and may respond to assist in EMS / rescue operations.
- Heavy Rescue Unit -- Rescue unit staffed and equipped for high angle, confined space, and trench rescue.

Houston Fire Department EMS and Rescue Procedures

- Incident Command must ensure that adequate patient information is provided to Main Gate Dispatch for HFD EMS requests.
- If an Engine or Ladder Company arrives first, they will be escorted to the scene upon direction from Command.
- Ambulances, medic units, EMS Supervisors, or rescue units shall be escorted to the scene as directed by Command.
- Other HFD resources shall be utilized by Command as deemed necessary. Additional resources may be requested if necessary. Additional HFD resources will be directed to stage on Lawndale or in the CIMA Staging Area.

DOCUMENT NO:	HSE-EAP-014	PAGE:	15 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- A unified command structure may be organized as necessary for mass casualty incidents.
- Adequate patient information shall be provided to the HFD EMS Officer in charge. This information should be in writing (see EMS Form in EAP volume titled **ADMINISTRATIVE PLANS**) and reviewed directly with the Officer. During this transition process, communications are critical.
- For mass casualty incidents, an HFD Command Officer will be requested to stay with Command at the Field Command Post. Additional HFD EMS Officers may be assigned to or assist the Triage, Treatment and Transport Unit Leader(s).

Lifelight - Memorial-Hermann Hospital

Primary medivac operations are conducted by Memorial-Hermann Hospital Lifelight. Lifelight helicopters deliver EMS personnel to the scene and provide expedient transportation to the trauma center at Memorial-Hermann Hospital.

The requesting of Lifelight may be, but is not limited to, the following types of emergency medical incidents:

- Multi-system Trauma
- Large percent burns
- Burns to specific body regions
- Severe head/neck injuries

Helicopter Landing Zones

Helicopter Landing Zones have been designated for the refinery. These Landing Zones may be used to support medivac (Lifelight) and other emergency helicopter operations. Helicopter Landing Zones are designated as one of the following:

- Heliports
- Designated Landing Zones (LZ)

LANDING ZONE	LOCATION
Heliport	East side of Gate 3 (Main Gate)
Heliport	Northeast side of the facility between the Ship Channel and the East Guard Basin
Designated Landing Zone	Designated location on Lawndale Street

ER - Command may alter and set up additional Landing Zones as circumstances require.

DOCUMENT NO:	HSE-EAP-014	PAGE:	16 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

Heliport Procedures

A heliport is an area of land used for helicopter landing and takeoff operations. For the purpose of this document, this area is permanently marked and designed for the intended use.

The following procedures should be followed when using heliports:

- Mark the LZ:

During night operations, if the area does not have designation lighting, the area shall be marked by flares or portable strobe lights.
- Incident Command shall ensure that the heliport is secured from unauthorized personnel.
- Establish ground contact with landing aircraft. Incident Command shall be ground contact unless this duty is assigned to another officer.
- *For heliports a fire/rescue standby is not required.*

Designated Landing Zone Procedures

Designated Landing Zones are temporary areas established for helicopter landing and takeoff operations.

The following procedures should be followed to set up a safe landing zone for helicopter operations:

- Determine the location of the LZ:

If possible all LZ locations should be on a hard paved surface. All refinery pre-determined locations are on a paved surface.

The LZ must be: **60' square (Day)**
 100' square (Night)

For LZ diagram see [Attachment 3: Landing Zone Operations](#).

If a dust hazard exists, the area may be lightly wetted down.
- Mark the LZ:

The LZ shall be marked by flares or portable strobe lights. Fluorescent orange cones may be used during the day.
- Establish ground contact with landing aircraft. Incident Command shall be ground contact unless this duty is assigned to another officer.

DOCUMENT NO:	HSE-EAP-014	PAGE:	17 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Ground to Air Contact

PRIMARY

FIRE MUTUAL AID (154.280)

SECONDARY

CIMA (b) (7)(F), (b) (3)

Medivac Helicopter units may not land without a confirmed ground contact.

- Communicate LZ location and hazard information.

Advise the pilot of the following conditions:

- ⇒ Terrain hazards (e.g., level or slope, rocks or brush, paved or dusty roads)
- ⇒ Obstacles (e.g., street signs, vehicles, trees, antennas or utility lines)
- ⇒ Wind direction (e.g., wind direction, flare, portable strobes or marking cones on each corner of LZ with a fifth marking on the upwind side.)

To facilitate LZ safety, a fire and rescue standby should be placed at landing zones as follows:

- A foam pumper staged and readied for immediate fire attack.
- A standby crew of at least two (2) personnel in full turnout gear and SCBA placed for immediate rescue operations.
- All personnel will stage behind the foam engine during landing and take-off.
- At night, turn off all strobe lights on vehicles near the LZ to prevent vision problems for the pilot.
- Do not illuminate the LZ with flood lights to prevent possible blinding of the pilot. Illumination used in the area should be directed towards the ground onto the scene and away from the LZ.
- Approach the helicopter from the front and ONLY when signaled to do so by the pilot or a crew member.

DOCUMENT NO:	HSE-EAP-014	PAGE:	18 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

Medivac (Lifelight) Procedures

Requests for Lifelight, or any other medivac service, should be made to the helicopter dispatcher by phone (landline).

By landline provide the following information:

- Patient information
- Landing location
- Ground contact radio channel and frequency

Proper radio procedures are to await the incoming flight's call for landing instructions and patient information. Previous to this, the pilot will not be monitoring for a ground contact.

- Incident Command must ensure that adequate patient information is provided to Main Gate Dispatch for Lifelight requests.
- Proper Landing Zone (LZ) must be provided and ground contact established.
- On arrival, the Lifelight EMS Officer shall be escorted directly to the scene or to a safe location to await delivery of patient.
- Adequate patient information shall be provided to the Lifelight Officer in charge. This information should be in writing and reviewed directly with the Officer. During this transition process, communication is critical.
- For mass casualty incidents, the refinery incident command system may request to have a Lifelight Medical Officer working with the Triage Unit Leader.

HAZARDOUS MATERIALS RESPONSE - HAZMAT TEAMS

The Houston Fire Department is available to assist with facility hazardous materials spills or releases.

For CIMA Hazmat capabilities see **Channel Industries Mutual Aid**.

Houston Fire Department

The Houston Fire Department (HFD) may provide hazardous materials support with their Hazardous Materials Response Team (HM-22).

HFD will may be notified and requested to respond during the activation of an Alert 2 or greater emergency - Fire, Spill, or Gas Release.

Procedures for Hazardous Materials Response

DOCUMENT NO:	HSE-EAP-014	PAGE:	19 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Due to the nature of the refinery emergencies, procedures to be followed for a HFD Hazmat Response are typically similar to that of a fire suppression response. The Houston Fire Department HAZMAT Team automatically responds with all HFD alarm assignments for fires, spills or releases.

OIL SPILL WATER - OIL SPILL RESPONSE TEAMS

Beyond initial spill containment response and some degree of minor cleanup for marine spills, Houston Refining relies on outside contractors and a spill association to provide material and manpower for complete spill containment, removal of floating spillage, and clean-up of affected areas.

The following contractor and spill association are under contract with Houston Refining.

- Garner Environmental
- Clean Channel Association

A companion document to be used in conjunction with the Emergency Action Plan is the Houston Refining *SPILL RESPONSE AND PREVENTION PLAN*. The Spill Response and Prevention Plan describes how Houston Refining will respond to spills that occur in the facility. These spills can be land-based within the refinery resulting from a variety of operations including, but not limited to, tank or pipeline liquid releases or from liquid spills to water at Houston Refining's Marine Terminal.

For detailed information on outside resources for spill response, see the SPILL RESPONSE AND PREVENTION PLAN (SRPP)

LAW ENFORCEMENT: LOCAL LAW ENFORCEMENT AGENCIES

Several local, state and federal law enforcement agencies provide assistance and govern laws within the facility and surrounding community.

The majority of the refinery is located in the City of Houston. However, the Houston Refining Recreation Facility is in the city of Pasadena.

Law enforcement agencies may be called or may respond to the facility for reasons such as the following:

DOCUMENT NO:	HSE-EAP-014	PAGE:	20 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

- Criminal investigations
- Fire investigations
- Searches
- Serving of warrants
- Crime in progress
- Pursuit of suspect through the facility
- Trespassing violations
- Public safety
- Securing of public roads adjacent to the facility.

Law Enforcement Procedures

Entry into the Facility

- On arrival of any law enforcement official, the **Plant Shift Superintendent, the Manager – Emergency Services & Security, and the Security Supervisor shall be notified**. Depending on the sense of urgency concerning the response, having one of these personnel meet with the law enforcement officials may be beneficial.
- The law enforcement official **should be escorted through the facility** as they request.
- If the law enforcement agency enters the refinery rapidly, e.g., in pursuit of a suspect or to make a felony arrest, Houston Refining Security personnel shall **safely** ensue and observe the actions in order to promote the safety of refinery personnel. Security personnel shall follow all orders of law enforcement personnel under such circumstances.
- Houston Refining Safety and Security personnel shall assist law enforcement personnel for investigations and other requests.
- Responsible attempts should be made to inform officials of refinery safety regulations and hazards.
- For minor investigations, an HSE Security Representative may be the company liaison. For substantial investigations, a liaison or liaison group may be appointed by management. This liaison group may include a representative from legal.

DOCUMENT NO:	HSE-EAP-014	PAGE:	21 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Response To Refinery Emergency Alerts

- The first arriving or Law Enforcement Command Officer shall meet with Security Support or with the Security Coordinator if the Security Supervisor is not on site. Depending on the immediate need for support, the officer may be escorted directly to Incident Command at the Command Post.

The Security Support Unit serves as the primary liaison with law enforcement agencies.

- Law enforcement resources may be utilized by incident Command or Emergency Operations as deemed necessary.
- A unified command structure may be organized as necessary.
- A law enforcement official may be requested to stay at the Command Post or in EOC to assist in managing law enforcement resources.

For securing adjacent off-site roadways, see the [HSE-EAP-004 Emergency Site Security and Control](#).

REFINERY STAGING AREAS

A staging area is established for temporary location of available mutual aid resources on three-minute notice. The staging areas are established by Incident Command to control resources not immediately assigned. The Staging Area Manager manages all aspects of the area. A staging area may include temporary sanitation services and fueling areas. All incoming resources report to staging where they are checked in until requested.

Staging areas for the refinery have been pre-designated to position incoming outside emergency equipment and resources. Incident Command will provide orders on which area to use or may opt to substitute another area as event circumstances require.

(b) (7) (F), (b) (3)

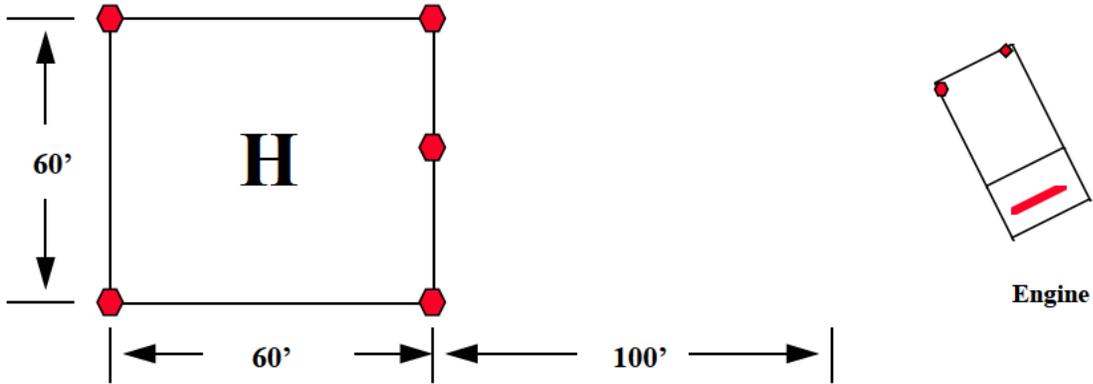
DOCUMENT NO:	HSE-EAP-014	PAGE:	22 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Pre-designated Refinery Staging Areas are used for emergency equipment staging only. These areas may not be used for any other purpose without the expressed written consent of the Manager, HSE.

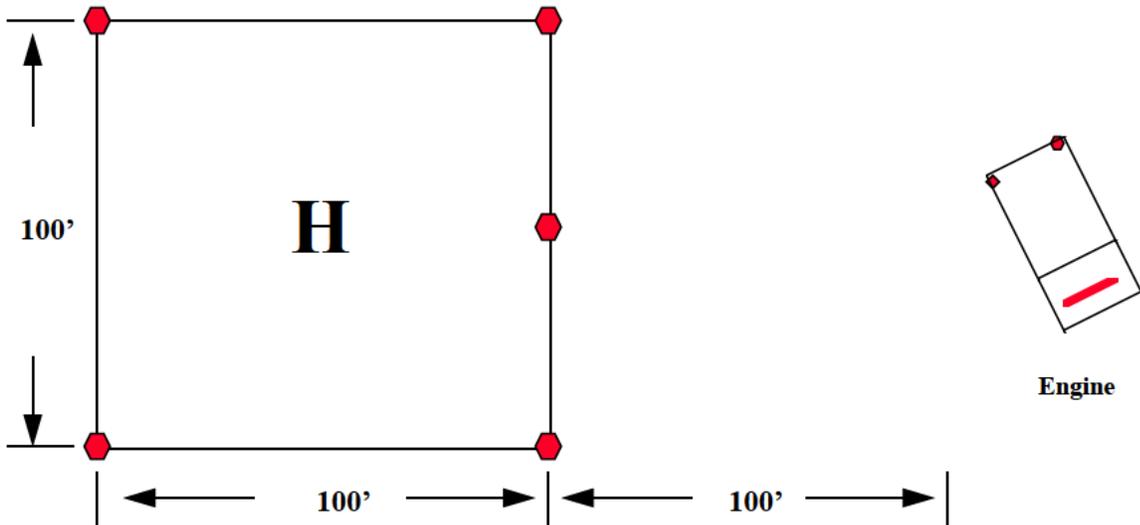
DOCUMENT NO:	HSE-EAP-014	PAGE:	23 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

Attachment 3: Landing Zone Operations

Landing Zone: Day



Landing Zone: Night



DOCUMENT NO:	HSE-EAP-014	PAGE:	24 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	J. Windham	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-011	Page: 1 OF 66	Approval Date:	06/30/2011
Document Title:	TRAINING AND EXERCISE PLAN				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	06/15/2011	

Training and exercising provides a means for refinery organizations to prepare and validate emergency action capabilities. The benefits of these activities are numerous. While they add value by meeting the organization's loss control and personnel safety requirements, they also meet external and regulatory agency requirements.

Benefits of training and exercising include:

- enhancing capabilities;
- improving coordination and proficiency;
- finding improvement opportunities;
- identifying and preplanning resources;
- validating existing systems, processes, plans and procedures;
- meeting regulatory compliance requirements;
- responding to community needs ; and
- demonstrating a commitment to preparedness.

TRAINING AND EXERCISE PROGRAM

All business management involves strategic planning. Emergency management programs involve the same essential planning to maximize effectiveness.

Training and exercise planning enables organizational goals and objectives to be identified, developed, and implemented. Planning also allows for the integration of goals between two or more groups to allow for a combination of exercise activities.

The following types of activity are encompassed by and considered integral parts of the overall emergency management training and exercise program.

Training Activity

Training activities describe training and educating emergency management or other groups on strategies and tactics in relation to their area of responsibility. Sessions should include classroom and practical training using emergency response equipment.

Preplan Activity

Preplan Activities are meetings of an emergency management group or groups in order to discuss, plan, and document strategies and tactics for managing their area of responsibility. Preplan activities are useful in building relationships between participants and allowing for open discussion concerning how group or functional plans interact. Preplan activities are another useful way to train personnel on how to work and solve problems as a team.

DOCUMENT NO:	HSE-EAP-YYY	PAGE:	2 of 66
DOCUMENT NAME: Training and Exercise Plan			

Exercise Activity

Exercise activities are an umbrella term describing an activity that provides participants an opportunity to train and practice emergency and crisis management skills. Exercising should always provide positive learning opportunities and enable players to demonstrate skills and knowledge. A successful exercise or simulation links learning opportunities with lessons learned in a continuous cycle of improvement. The exercise cycle includes phases of planning, program design, development and evaluation. Evaluation allows for continuous improvement and revising of emergency plans. As each exercise is designed, developed, conducted and evaluated, lessons learned are incorporated into emergency action plans and the cycle begins again.

Several specific types of exercises are defined as follows:

Tabletop Exercise

An exercise activity conducted in a conference room setting, involving formal discussions on a scenario by an emergency management group. A tabletop exercise can be referred to as a “desktop exercise”.

Tabletop exercises may include outside support and response groups including, but not limited to, corporate personnel, law enforcement, local fire departments and regulatory agencies.

Drill

An exercise activity requiring a focused performance of only designated response activities by individuals and teams, to include mobilization of personnel and resources. Drills may be limited or full in scale. A limited drill involves a very specific group or function. A full drill evaluates capabilities in a broad range of functions.

Exercise

An exercise activity requiring performance, integration and coordination of response activities by several individuals and teams, as well as mobilization of personnel and resources. An exercise should be designed to mirror a real-life emergency as realistically as possible.

Full-Scale Exercise

An exercise, which validates the major aspects of an organization’s emergency and crisis management program and involves all levels of the organization.

DOCUMENT NO:	HSE-EAP-YYY	PAGE:	3 of 66
DOCUMENT NAME: Training and Exercise Plan			

Appendix 1: Emergency Management Training and Exercise Planning Summary exhibits emergency management training and exercise activities with the associated frequency requirements. The remainder of the Appendixs provide an explanation of the refinery groups involved, objectives of the sessions and groups responsible for development and implementation of the programs. This information composes the organization's training and exercise program. The Appendixs represent planned minimum facility requirements. Training and exercise requirements may be revised according to management decision in relation to organizational identified needs.

As allowed by some compliance standards, actual events may be substituted for certain exercise requirements. In these cases, a critique of the event must be performed and documented.

Training and Exercise Planning

The Emergency Management Coordinator will guide the organization in attaining its goals and objectives for training and exercises.

The Emergency Management Coordinator develops, for management approval, the planning schedule for emergency management training and exercises.

The ERT Training Coordinator develops the schedule and manages training for the Emergency Response Team.

The planning schedule is attached as follows:

Appendix 1: Emergency Management Training and Exercise Planning Schedule

DOCUMENT NO:	HSE-EAP-YYY	PAGE:	4 of 66
DOCUMENT NAME:			
Training and Exercise Plan			

Training and Exercise Guidelines

The following Appendixes outline the design, development, reporting guidelines, and documentation requirements for specified training and exercise activities.

- Appendix 2: Building Fire Evacuation Drill*
- Appendix 3: CIMA Annual Training Symposium*
- Appendix 4: CIMA Zone Drill (Participant)*
- Appendix 5: CIMA Zone Drill - Full Scale Exercise - Refinery (Hosting Drill)*
- Appendix 6: Clean Channel Association Drill (Participant)*
- Appendix 7: Clean Channel Association Drill – Refinery (Hosting Drill)*
- Appendix 8: Emergency Action Plan Review – Regulatory Training*
- Appendix 9: Emergency Operations EOC Preplan and Tabletop Exercise*
- Appendix 10: ERT Apparatus Training and Drill*
- Appendix 11: ERT EMS Continuing Education (CE)*
- Appendix 12: ERT Fire School (Off-site)*
- Appendix 13: ERT Marine Spill Team Training and Drill*
- Appendix 14: ERT Officer's Training, Drill and Business Meeting*
- Appendix 15: ERT Rescue/EMS Training (Qualification)*
- Appendix 16: ERT Rescue/EMS Training and Drill*
- Appendix 17: ERT Training and Drill, Firefighter/Hazardous Materials Technician (Qualification)*
- Appendix 18: ERT Training and Drill*
- Appendix 19: Evacuation Drill*
- Appendix 20: First Responder Awareness Training (Qualification)*
- Appendix 21: First Responder Operations Training (Qualification)*
- Appendix 22: Houston Fire Department Preplan Meeting*
- Appendix 23: Marine Spill Drill - Unannounced*
- Appendix 24: Notification Drill (Weekly)*
- Appendix 25: On-Scene Incident Command Training (Qualification)*
- Appendix 26: Response and Evacuation Drill*
- Appendix 27: SCDI Response Team Training*
- Appendix 28: Marine Spill Deployment Exercise Documentation*
- Appendix 29: Marine Spill Management Team Tabletop Exercise Documentation*
- Appendix 30: Notification Drill (Weekly), QI Notification Exercise Documentation*

DOCUMENT NO:	HSE-EAP-YYY	PAGE:	5 of 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 1

EMERGENCY MANAGEMENT TRAINING AND EXERCISE PLANNING SUMMARY

Exercise	Frequency
Notification Drill (Weekly)	Weekly
ERT Officers Training, Drill and Business Meeting	Quarterly
ERT Rescue/EMS Training and Drill	Quarterly
ERT Training and Drill	Quarterly
Building Fire Evacuation Drill	Annual
CIMA Annual Training Symposium and/or Drill	Annual
CIMA Zone Drill (Participant)	Annual
Clean Channel Association Drill (Participant)	Annual
Emergency Action Plan Review - Regulatory Training	Annual
Emergency Operations EOC Preplan and Tabletop Exercise	Annual
Houston Fire Department Preplan Meeting	Annual
Marine Spill Drill - Unannounced	Annual
ERT Apparatus Training and Drill	Semi-annual
ERT Marine Spill Team Training and Drill	Semi-annual
Evacuation Drill	Semi-annual
Response and Evacuation Drill	Semi-annual
ERT EMS Continuing Education (CE)	As needed
ERT Rescue/EMS Training (Qualification)	As needed
ERT Training and Drill, Firefighter/Hazardous Materials Technician (Qualification)	As needed
First Responder Awareness Training (Qualification)	As needed
First Responder Operations Training (Qualification)	As needed
On-Scene Incident Command Training (Qualification)	As needed
Clean Channel Association Drill - Refinery (Hosting Drill)	As scheduled
ERT Fire School (Off-Site)	As scheduled
CIMA Zone Drill - Full Scale Exercise - Refinery (Hosting Drill)	As scheduled

* The presented information is intended for planning purposes. Actual scheduling may vary due to shift schedules, emergencies, operational considerations or sponsor organization revisions. Due to the unavailability of information, some items are intentionally left unscheduled

DOCUMENT NO:	HSE-EAP-YYY	PAGE:	6 of 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 2

BUILDING FIRE EVACUATION DRILL GUIDELINE

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Annual
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 1 hour
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • HRO personnel in specified buildings with large occupancies such as, but not limited to: <ul style="list-style-type: none"> ⇒ Main Office(s) ⇒ Laboratory ⇒ Maintenance Offices and Shops • Recommended that contractors cover similar material with their personnel.
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Exercise and practice fire evacuation of major refinery occupancies.
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • OSHA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Emergency Management will coordinate drill.
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • Drill only
Drill Critique:	<ul style="list-style-type: none"> • Emergency Management will critique drill performance and report.
Training Review:	<ul style="list-style-type: none"> • No review required, drill only.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved documentation procedure</i>. • The Emergency Management Coordinator is responsible for completing all documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	7 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 3**CIMA ANNUAL TRAINING SYMPOSIUM
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Annual
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 4 to 16 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Emergency Response Team. • Some courses may be appropriate for Emergency Operations (EOC) personnel
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Participate in training/education activities offered by CIMA Group • Allows advanced training in specialty classes for ERT personnel • Allows further advanced training in CIMA procedures and command systems.
Compliance Required Objectives	<ul style="list-style-type: none"> • No
Compliance Group(s)	<ul style="list-style-type: none"> • N/A
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Instructors: <ul style="list-style-type: none"> ⇒ CIMA member instructors ⇒ HRO Emergency Management instructors as requested by the organization. • Emergency Management to prepare subject matter as required. • ERT Training Coordinator will coordinate and set up Emergency Response Team attendance and determine most effective classes to meet HRO ERT requirements.
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • No required topics • CIMA organization provides topic list annually to meet organization's needs.
Drill Critique:	<ul style="list-style-type: none"> • No critique required, training only
Training Review:	<ul style="list-style-type: none"> • Training review as required by CIMA class.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved documentation procedures</i>. • ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	8 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 4**CIMA ZONE DRILL (PARTICIPANT)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Annual
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 4 to 8+ hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Emergency Response Team
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Participate in Zone exercise to include but not be limited to: <ul style="list-style-type: none"> ⇒ Communications ⇒ ICS coordination ⇒ HRO ERT performance with CIMA resources • Exercise scope may include LEPC participation
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • CIMA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • The ERT Training Coordinator will coordinate and set up Emergency Response Team attendance and refinery response equipment deployment. • The Emergency Management group may supply personnel for <i>Exercise Development Team</i>
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • No required topics • CIMA organization provides drill GUIDELINE to meet organization's needs.
Drill Critique:	<ul style="list-style-type: none"> • CIMA hosting member designs and conducts critique
Training Review:	<ul style="list-style-type: none"> • No training review required
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Exercise documentation and recordkeeping will be performed according to <i>approved documentation procedures</i>. • The ERT Training Coordinator is responsible for completing all exercise documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	9 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 5

**CIMA ZONE DRILL - FULL SCALE EXERCISE - REFINERY
(HOSTING DRILL)
GUIDELINE**

<p>Frequency: <i>Training frequency requirement</i></p>	<ul style="list-style-type: none"> • As scheduled <i>Note: Frequency determination may be dependent on CIMA multi-year planning of exercises for the organization.</i> • <i>Note: Full-scale exercise satisfies requirement of one (1) semi-annual Response and Evacuation Drill.</i>
<p>Hours/Session: <i>Estimated hours per session</i></p>	<ul style="list-style-type: none"> • 4 to 8+ hours
<p>Group(s) involved: <i>Target Audience</i></p>	<ul style="list-style-type: none"> • Refinery personnel • Refinery Emergency Management groups • Emergency Response Teams. • May involve LEPC Members. • May involve community participation. • May involve area and regional hospital participation. • May involve local, state and federal agencies.
<p>Objective: <i>General training objective(s)</i></p>	<ul style="list-style-type: none"> • Full exercise to validate and test major aspects of emergency action plans. • Exercise emergency action evacuation plans (exercise should contain evacuations). • Exercise plans with LEPC entities. • Exercise CIMA and other mutual aid organizations. • Exercise notifications and plans with regulatory governmental organizations.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	10 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

CIMA ZONE DRILL - FULL SCALE EXERCISE - REFINERY (HOSTING DRILL) GUIDELINE

Compliance Required Objectives	<ul style="list-style-type: none"> • No
Compliance Group(s)	<ul style="list-style-type: none"> • N/A
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Exercise Coordinator: Emergency Management Coordinator • The Exercise Coordinator is responsible for: <ul style="list-style-type: none"> ⇒ Managing exercise conduction. ⇒ Forming and organizing an <i>Exercise Development Team</i>. The team is responsible for designing, developing, conducting and evaluating the exercise. • The Development Team will be composed of refinery personnel, LEPC members and CIMA Representatives. • The Exercise Coordinator will assign Development Team Members to subcommittees including but not limited to the following: <ul style="list-style-type: none"> ⇒ Control Team (Lead Controller and team members) ⇒ Evaluation Team (Evaluation Team Leader and team members). • Emergency Management is responsible for preparing subject matter and drill scenario as required. • ERT Training Coordinator will coordinate and set up Emergency Response Team attendance.
Implementation Information	<ul style="list-style-type: none"> • Exercise should be developed in phases: <ul style="list-style-type: none"> ⇒ Development ⇒ Conduct ⇒ Evaluation ⇒ Follow-up. • Requires 6 to 8 months planning. • Requires expense budget considerations. • Dependent on the scenario, compliance exercise credit may be received from the following compliance groups: <ul style="list-style-type: none"> ⇒ USCG ⇒ EPA ⇒ DOT ⇒ TX GLO.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	11 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

**CIMA ZONE DRILL - FULL SCALE EXERCISE - REFINERY
(HOSTING DRILL)
GUIDELINE**

Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> The Exercise Development Team working in conjunction with the local LEPC and CIMA will develop exercise scope to meet requirements for testing the respective emergency action plans.
Drill Critique:	<ul style="list-style-type: none"> A formal critique according to critique and follow-up procedures. <i>See Critique Procedures.</i>
Training Review:	<ul style="list-style-type: none"> No training review required.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> Training documentation and recordkeeping will be performed according to <i>approved documentation procedures.</i> The Emergency Management Coordinator is responsible for completing all exercise documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	12 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 6**CLEAN CHANNEL ASSOCIATION DRILL (PARTICIPANT)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> As Scheduled HRO goal is to participate annually
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 4 to 8+ hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Marine Spill Team Representative ERT Spill Team or HRO Spill Response contractor
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Exercise Clean Channel response plans. Participate in association exercise to include, but not be limited to: <ul style="list-style-type: none"> ⇒ Communications ⇒ ICS coordination ⇒ Performance with CIMA resources. Deployment of mutual aid association equipment Exercise spill scene management.
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> EPA CCA TX GLO USCG
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Emergency Management Coordinator and the Environmental Engineer assigned to spill response planning will coordinate and represent HRO interests with Clean Channel drills. ERT Training Coordinator will coordinate and set up Emergency Response Team attendance and refinery response equipment deployment. The Emergency Management group may supply personnel for drill development.
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> The Clean Channel organization provides drill GUIDELINE to meet organization's needs.
Drill Critique:	<ul style="list-style-type: none"> Clean Channel and the hosting member designs and conducts critique.
Training Review:	<ul style="list-style-type: none"> No training review required.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> Exercise documentation and recordkeeping will be performed according to <i>approved documentation procedures</i>.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	13 OF 66
DOCUMENT NAME: Training and Exercise Plan			

CLEAN CHANNEL ASSOCIATION DRILL (PARTICIPANT) GUIDELINE

- The Emergency Management Coordinator is responsible for completing any exercise documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	14 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 7

**CLEAN CHANNEL ASSOCIATION DRILL - REFINERY
(HOSTING DRILL)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> As scheduled
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 4 to 8+ hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Emergency Operations (EOC) Emergency Response Command and Operations ERT Marine Spill Team and HRO Spill Response Contractor Oil Movements Operations Clean Channel member response teams
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Exercise Clean Channel response plans. Deploy mutual aid association equipment. Full exercise to validate and test major aspects of Emergency Action and Spill Response Plans. Exercise notifications and plans with regulatory governmental organizations. Regulatory agency Spill Drill Credit received for this exercise.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	15 OF 66
DOCUMENT NAME: Training and Exercise Plan			

CLEAN CHANNEL ASSOCIATION DRILL - REFINERY (HOSTING DRILL) GUIDELINE	
Compliance Required Objectives	<ul style="list-style-type: none"> • Credit Received
Compliance Group(s)	<ul style="list-style-type: none"> • CCA • EPA • TX GLO • USCG
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Exercise Coordinator: Emergency Management Coordinator • Assistant Exercise Coordinator: Assigned Environmental Engineer • The Exercise Coordinator is responsible for: <ul style="list-style-type: none"> ⇒ Managing the entire operation, and ⇒ Forming and organizing an Exercise Development Team. The team is responsible for designing, developing, conducting and evaluating the exercise. • The Development Team will be composed of refinery personnel and Clean Channel members. • The Exercise Coordinator will assign Development Team Members to subcommittees including but not limited to the following: <ul style="list-style-type: none"> ⇒ Control Team (Lead Controller and team members) ⇒ Evaluation Team (Evaluation Team Leader and team members). • Emergency Management is responsible for preparation of subject matter as required. • ERT Training Coordinator will coordinate and set up ERT Spill Team attendance and participation.
Implementation Information	<ul style="list-style-type: none"> • Exercise should be developed in phases: <ul style="list-style-type: none"> ⇒ Development ⇒ Conduct ⇒ Evaluation ⇒ Follow-up • Requires 3 months planning. • Requires expense budget considerations. • Compliance exercise credit may be received from the following compliance groups: <ul style="list-style-type: none"> ⇒ USCG ⇒ EPA

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	16 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

**CLEAN CHANNEL ASSOCIATION DRILL - REFINERY
(HOSTING DRILL)
GUIDELINE**

	<ul style="list-style-type: none"> ⇒ DOT ⇒ TX GLO.
<p>Required Training Topics: <i>Required minimum specific training topics to meet objective</i></p>	<ul style="list-style-type: none"> • The Exercise Development Team, working in conjunction with Clean Channel, will develop exercise scope to meet requirements for testing the respective emergency action plans and Clean Channel response plans.
<p>Drill Critique:</p>	<ul style="list-style-type: none"> • A formal critique according to incident critique procedures. <i>See Critique Procedures.</i>
<p>Training Review:</p>	<ul style="list-style-type: none"> • No training review required.
<p>Required documentation: <i>Documentation required for sessions</i></p>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved documentation procedures.</i> • <i>For scenarios that include a Spill Equipment Deployment, documentation must include a completed Spill Deployment Exercise Form, Appendix 33: Spill Deployment Exercise Documentation.</i> • The Emergency Management Coordinator is responsible for completing all exercise documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	17 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 8

EMERGENCY ACTION PLAN REVIEW - REGULATORY TRAINING GUIDELINE	
Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Annual
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 1 – 4 hours • Session may be computer-based training (CBT).
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • HRO personnel
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Basic knowledge and review of Emergency Action Plan • Evacuation Plan review • Employee Alarm Systems • Hazwoper First Responder Awareness - Qualification • Hazwoper First Responder Awareness - Refresher • Hazwoper First Responder Operations - Refresher • Hazard Communications training refresher as required • Recognize hazardous materials, the risk they pose, and the possible outcomes of a release. • Identify released hazardous materials, if possible. • Recognize the need for additional resources and notify the proper authorities of an incident/emergency. • Be able to provide site control, if requested.
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • OSHA • EPA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Instructors may be: <ul style="list-style-type: none"> ⇒ Emergency Management ⇒ Other HSE personnel ⇒ Operations/Maintenance Training ⇒ Other qualified Trainers assigned • Emergency Management will prepare subject matter revising annually as required. • Operations/Maintenance Training will coordinate audience attendance.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	18 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

EMERGENCY ACTION PLAN REVIEW - REGULATORY TRAINING GUIDELINE	
<p>Required Training Topics: <i>Required minimum specific training topics to meet objective</i></p>	<ul style="list-style-type: none"> • How to Report an Incident or Emergency • Emergency Notification and Response • Evacuation and Personnel Accounting • Emergency Management Organization • Emergency Operations - Field • Site Security and Control • Severe Weather Management • Bomb Threat Procedures • Civil Disturbance and Enemy Attack Plan • Identification of hazardous materials • Hazardous properties of materials • Classes of hazardous materials
<p>Drill Critique:</p>	<ul style="list-style-type: none"> • No critique required, training only.
<p>Training Review:</p>	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures</i>.
<p>Required documentation: <i>Documentation required for sessions</i></p>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved documentation procedures</i>. • Operations/Maintenance Training is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	19 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 9**EMERGENCY OPERATIONS EOC PREPLAN AND TABLETOP EXERCISE GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Annual
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 4 Hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Emergency Operations (EOC) and alternates • Representatives from Emergency Operations - Field <ul style="list-style-type: none"> ⇒ Field Coordinator ⇒ Emergency Response - Command ⇒ Emergency Response - Operations
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Exercise knowledge and components of Emergency Action and Spill Response Plans. • Exercise Emergency Operations (EOC) functional plans. • Preplan EOC management items and functional plans. • Scenario will be worst case every 3rd year.
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • EPA • USCG • DOT • TX GLO
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Exercise Coordinator: Emergency Management Coordinator • The Exercise Coordinator is responsible for: <ul style="list-style-type: none"> ⇒ Facilitating the exercise. ⇒ Forming and organizing, designing, developing, conducting and evaluating the exercise. • Emergency Management is responsible for preparation of subject matter as required.
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • Scenario shall include a marine oil spill. • Scenario will be worst case every 3rd year.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	20 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

EMERGENCY OPERATIONS EOC PREPLAN AND TABLETOP EXERCISE GUIDELINE

Drill Critique:	<ul style="list-style-type: none"> • The Tabletop Exercise must be completed with an action planning session that may include the following: <ul style="list-style-type: none"> ⇒ organization capabilities that should be added or supplemented ⇒ participants may identify functional requirements and/or improvements for their respective area ⇒ identification of policies and procedures that may require review. • Critiques serve as a learning performance tool for the group. • <i>Most critique items will identify areas for functional plan improvements. The Emergency Management Coordinator will document items identified that have global facility wide impact.</i>
Training Review:	<ul style="list-style-type: none"> • No review required, exercise only.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Agendas or other documents generated for or during the meeting will be properly filed. • <i>For scenarios that include a Spill, documentation must include a completed Appendix 32: Spill Management Team Tabletop Exercise Form.</i> • Exercise documentation and recordkeeping will be performed according to <i>documentation procedures</i>. • The Emergency Management Coordinator is responsible for completing all documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	21 OF 66
DOCUMENT NAME: Training and Exercise Plan			

APPENDIX 10**ERT APPARATUS TRAINING AND DRILL
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> As scheduled Apparatus operators should attend semi-annually
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 8 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Emergency Response Team
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Apparatus driver / operator qualification on mobile pumping apparatus Apparatus driver / operator refresher training
Compliance Required Objectives	<ul style="list-style-type: none"> No
Compliance Group(s)	<ul style="list-style-type: none"> N/A
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Instructors: <ul style="list-style-type: none"> ⇒ ERT personnel ⇒ Outside Instructors (As required) The ERT Training Coordinator will coordinate the school. ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> Water supplies & establishing water supplies Theory of centrifugal pumps Pump operation Foam system operation Aerial device operation Relay pumping Drafting
Drill Critique:	<ul style="list-style-type: none"> A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. This critique exists as a learning performance tool for the response team. <i>No Formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>
Training Review:	<ul style="list-style-type: none"> Training review required according to <i>approved procedures.</i>
Required documentation:	<ul style="list-style-type: none"> Training documentation and recordkeeping will be

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	22 OF 66
DOCUMENT NAME: Training and Exercise Plan			

ERT APPARATUS TRAINING AND DRILL GUIDELINE

Documentation required for sessions

- performed according to *approved procedures*.
- Agency notification required for live fire training. All notifications must be documented.
- The ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	23 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 11**ERT EMS CONTINUING EDUCATION (CE)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> Dictated by state CE and re-certification requirements. Classes are offered to members as scheduled.
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> CE and re-certification hours as set by State Dept of Health. 20 CE class hours per year will be offered to members. Additional hours, if any, needed to meet requirements will be via CBT, re-certification classes, etc.
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> State certified EMS providers to include: <ul style="list-style-type: none"> ⇒ ECA: Emergency Care Attendants ⇒ EMT - B: Emergency Medical Technician, Basic ⇒ EMT - I : Emergency Medical Technician, Intermediate ⇒ EMT - P: Emergency Medical Technician, Paramedic
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Maintenance of state EMS certification proficiencies and certifications.
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> Texas State Dept of Health
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Instructors: State qualified EMS Instructors The ERT Training Coordinator will coordinate the school. The ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.
Required Training Topics: <i>Minimum specific training topics to meet required annual objective</i>	<ul style="list-style-type: none"> As defined by state requirements
Drill Critique:	<ul style="list-style-type: none"> Training only; no critique required.
Training Review:	<ul style="list-style-type: none"> EMS Skills qualification and examination according to state re-certification requirements.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> Training documentation and recordkeeping will be performed according to according to <i>approved procedures</i>. The ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	24 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 12**ERT FIRE SCHOOL (OFF-SITE)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Bi-annually as scheduled
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 16 to 24 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Emergency Response Team
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Training and drilling at Texas A&M or comparable Fire School. • Live fire training
Compliance Required Objectives	<ul style="list-style-type: none"> •
Compliance Group(s)	<ul style="list-style-type: none"> •
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Instructors: HRO ERT personnel and instructors from Texas A&M or other CIMA companies. • ERT Training Coordinator will coordinate the school for HRO ERT personnel. • ERT Training Coordinator will represent HRO ERT on Steering Committee.
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • Live fire training • Drill to include a live fire scenario utilizing the ICS System.
Drill Critique:	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team. <i>No formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>
Training Review:	<ul style="list-style-type: none"> • Training review required according to Steering Committee's recommendation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	25 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT FIRE SCHOOL (OFF-SITE) GUIDELINE

Required documentation:
Documentation required for sessions

- Training documentation and recordkeeping will be performed according to *approved documentation procedures*.
- The ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	26 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 13**ERT MARNE SPILL TEAM TRAINING AND DRILL
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Semi-annual
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 8 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • ERT Marine Spill Team
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Classroom and practical training and education <ul style="list-style-type: none"> ⇒ Practical boat handling skills and Safety ⇒ Practical Deployment skills • Exercise and practice skills and field management <ul style="list-style-type: none"> ⇒ Deploy boom (1000' minimum at least once per year). • Practice incident command skills. • Requires HRO Spill Contractor participation annually (one session/year).
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • EPA • USCG • TX GLO
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Instructors: <ul style="list-style-type: none"> ⇒ Spill Team personnel ⇒ Outside Spill Contractor Instructors (As required) • The ERT Training Coordinator will coordinate the school. <ul style="list-style-type: none"> ⇒ ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.
Required Training Topics: <i>Minimum specific training topics to meet required annual objective</i> <i>Topics that must be reviewed annually</i>	<ul style="list-style-type: none"> • Oil Spill Recovery On Water: <ul style="list-style-type: none"> ⇒ Containment of Oil on water ⇒ Movement of Oil on water ⇒ Refinery procedures and contingency plans • Response Team Equipment: <ul style="list-style-type: none"> ⇒ Equipment familiarization ⇒ Equipment maintenance • Boat handling skills - practical • Drill will include spill scenario utilizing ICS with actual deployment of boom (minimum of 1000' annually).

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	27 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT MARNE SPILL TEAM TRAINING AND DRILL GUIDELINE

Drill Critique:	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team.
Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures</i>.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures</i>. • <i>For scenarios that include a Spill Equipment Deployment, documentation must include a completed Spill Deployment Exercise Form, Appendix 28: Spill Deployment Exercise Documentation.</i> • The ERT Training Coordinator is responsible for completing all training and critique documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	28 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 14

ERT OFFICER'S TRAINING, DRILL AND BUSINESS MEETING GUIDELINE

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Quarterly
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 8 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • ERT Officer's Group
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • OSHA 1910.156 Fire Brigade Leader training requirements • OSHA 1910.120 Field Incident Commander training (refresher)
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • OSHA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Instructors: <ul style="list-style-type: none"> ⇒ ERT personnel ⇒ Outside Instructors (as required) • The Emergency Management Coordinator will coordinate the school. • The Emergency Management Coordinator is responsible for subject matter (Lesson Plans) formation.
Required Training Topics: <i>Minimum specific training topics to meet required annual objective</i>	<ul style="list-style-type: none"> • Emergency Response Leadership • Incident Command Systems • Incident Management Simulations • Size Up • Strategy & Tactics • Fire Protection / Detection Systems • Pre-Planning
Drill Critique:	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team. • <i>No Formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	29 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT OFFICER'S TRAINING, DRILL AND BUSINESS MEETING GUIDELINE

Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures</i>.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures</i>. • Agency notification required for live fire training. All notifications must be documented. • The ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	30 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 15**ERT RESCUE/EMS TRAINING (QUALIFICATION)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> As needed
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 40 hours for Rescue EMS certification hours as dictated by the State Department of Health Services
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Emergency Response Team Rescue/EMS Team new members
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Initial Rescue Training Minimum of Emergency Care Attendant (ECA) state certification Classroom and practical training and education in Rescue and Emergency Medical Services. Exercise and practice skills and field management. Practice incident command skills.
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> OSHA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Instructors: <ul style="list-style-type: none"> ⇒ Rescue Team personnel ⇒ Outside Rescue Instructors (As required) ⇒ Outside state certified EMS instructors The ERT Training Coordinator will coordinate the school(s). <ul style="list-style-type: none"> ⇒ The ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	31 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT RESCUE/EMS TRAINING (QUALIFICATION) GUIDELINE

<p>Required Training Topics: <i>Minimum specific training topics to meet required objective</i></p>	<ul style="list-style-type: none"> • Overview of OSHA 29 CFR 1910.146 <ul style="list-style-type: none"> ⇒ Rescue requirements ⇒ Definitions • Confined Space Rescue to include: <ul style="list-style-type: none"> ⇒ Equipment familiarization ⇒ Knots, anchor points, and rigging procedures ⇒ Access and egress methods ⇒ Equipment maintenance. • High Angle Rescue to include: <ul style="list-style-type: none"> ⇒ Equipment familiarization ⇒ Knots, anchor points, and rigging procedures ⇒ High angle rescue methods ⇒ Equipment maintenance. • ECA topics as required by state curriculum (a higher level of EMS training may be substituted). • Additional Emergency Medical Training to include: <ul style="list-style-type: none"> ⇒ Ambulance Equipment familiarization ⇒ Patient packaging and extrication ⇒ Semi-automatic External Defibrillator (SAED). • Protocol review • Drill will include a rescue scenario utilizing the ICS System.
<p>Drill Critique:</p>	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team. • <i>No Formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>
<p>Training Review:</p>	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures.</i>
<p>Required documentation: <i>Documentation required for sessions</i></p>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures.</i> • The ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	32 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 16**ERT RESCUE/EMS TRAINING AND DRILL
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Quarterly
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 8 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Emergency Response Team Rescue / EMS Team
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Classroom and practical training and education in Rescue and Emergency Medical Services. • Exercise and practice skills and field management. • Practice of incident command skills.
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • OSHA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Instructors: <ul style="list-style-type: none"> ⇒ Rescue Team personnel ⇒ Outside Rescue Instructors (as required) ⇒ Outside EMS Instructors (as required) • The ERT Training Coordinator will coordinate the school. • The ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	33 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT RESCUE/EMS TRAINING AND DRILL GUIDELINE	
<p>Required Training Topics: <i>Minimum specific training topics to meet required annual objective</i></p> <p><i>Topics that must be reviewed annually</i></p>	<ul style="list-style-type: none"> • Confined Space Rescue to include: <ul style="list-style-type: none"> ⇒ Equipment familiarization ⇒ Knots, anchor points, and rigging procedures ⇒ Access and egress methods ⇒ Equipment maintenance. • High Angle Rescue to include: <ul style="list-style-type: none"> ⇒ Equipment familiarization ⇒ Knots, anchor points, and rigging procedures ⇒ High angle rescue methods ⇒ Equipment maintenance. • Emergency Medical Training to include: <ul style="list-style-type: none"> ⇒ Protocol ⇒ Ambulance Equipment familiarization ⇒ Soft tissue and internal organs ⇒ Medical Emergencies ⇒ Patient packaging and extrication ⇒ Semi-automatic External Defibrillator (SAED) ⇒ Patient Assessment. • Drill to include a rescue scenario utilizing the ICS System.
Drill Critique:	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team. • <i>No Formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>
Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedure.</i>
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures.</i> • The ERT Training Coordinator is responsible for completing all training and critique documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	34 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 17

**ERT TRAINING AND DRILL
FIREFIGHTER/HAZARDOUS MATERIALS TECHNICIAN (QUALIFICATION)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> As needed
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 64 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Emergency Response Team new members
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Hazwoper Hazardous Material Technician qualification HRO ERT Firefighter qualification DOT Hazardous Materials Qualification Training Classroom and practical application The class is not required annually, but will be provided annually as required for ERT Qualifications (new member).
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> OSHA EPA NFPA DOT
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Instructors: <ul style="list-style-type: none"> ⇒ ERT personnel ⇒ Outside Instructors (as required) The ERT Training Coordinator will coordinate the school. <ul style="list-style-type: none"> ⇒ ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.
Required Training Topics: <i>Minimum specific training topics to meet required objective</i>	<ul style="list-style-type: none"> Fire Science Portable Fire Extinguishers Water Supply Systems and Appliances - General Portable Monitors Structural Fire Fighting Turnout Gear Hose Handling and Fire Streams Practice Fire Apparatus and Support Vehicle Operations and Specifications - All Units Supply Line and Attack Line Setup Respiratory Protective Equipment, Self Contained Breathing Apparatus

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	35 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT TRAINING AND DRILL FIREFIGHTER/HAZARDOUS MATERIALS TECHNICIAN (QUALIFICATION) GUIDELINE

	<ul style="list-style-type: none"> • Air Supplied Respirators • Interior Structural Firefighting • Search and Rescue • High Temperature Protective Clothing • Chemical Protective Clothing • Hazardous Materials Response Planning • Recognizing and Identifying Hazardous Materials • Risk/Hazard Assessment • Site and Scene Management • Emergency Action Plan • Toxicology • Decontamination • Monitoring and Surveying Equipment • Basic Method for Control and Containment • Plugging and Patching Devices and Containment • Fire Fighting Foam • Flammable Liquid Spill Fire Fighting and Vapor Suppression Control • Tank Fire Fighting • Refinery Fire Protection Systems • Gases • Hazards of Gases • Gas Emergency Control • Safety • Fire Fighting and Electricity • START Triage • Drill to include a scenario utilizing the ICS System • <i>For further information see the Emergency Response Team Training Manual, Firefighter/hazardous Materials Technician.</i>
Drill Critique:	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team. • <i>No Formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	36 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

**ERT TRAINING AND DRILL
FIREFIGHTER/HAZARDOUS MATERIALS TECHNICIAN (QUALIFICATION)
GUIDELINE**

Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures</i>.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures</i>. • Agency notification required for live fire training. All notifications must be documented. • <i>Certificates shall be issued to members and filed according to approved procedures.</i> • The ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	37 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 18**ERT TRAINING AND DRILL
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> Quarterly
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 8 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Emergency Response Team members
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Classroom and practical training and education Exercise and practice skills and field management. Practice incident command skills. Exercise land spill plans and HAZMAT skills. Drill must include tank or pipeline spill on land (minimum one quarter/year). Meets Hazwoper Hazardous Material Technician Refresher requirements. Meets Hazwoper Field Incident Commander Refresher requirements.
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> OSHA EPA DOT NFPA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Instructors: <ul style="list-style-type: none"> ⇒ ERT personnel ⇒ Outside Instructors (As required) The ERT Training Coordinator will coordinate the school. <ul style="list-style-type: none"> ⇒ ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.
Required Training Topics: <i>Minimum specific training topics to meet required annual objective</i> <i>Topics that must be reviewed annually</i>	<ul style="list-style-type: none"> Fire Science Portable Fire Extinguishers Water Supply Systems and Appliances - General Portable Monitors Structural Fire Fighting Turnout Gear Hose Handling and Fire Streams Practice Pump Operations - General Fire Apparatus and Support Vehicle Operations and Specifications - All Units Supply Line and Attack Line Setup

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	38 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT TRAINING AND DRILL GUIDELINE

	<ul style="list-style-type: none"> • Relay Pumping • Respiratory Protective Equipment, Self Contained Breathing Apparatus • Air Supplied Respirators • Search and Rescue • Interior Structural Firefighting • High Temperature Protective Clothing • Chemical Protective Clothing • Hazardous Materials Response Planning • Recognizing and Identifying Hazardous Materials • Risk/Hazard Assessment • Site and Scene Management • Emergency Action Plan • Toxicology • Decontamination • Monitoring and Surveying Equipment • Basic Method for Control and Containment • Plugging and Patching Devices and Containment • Fire Fighting Foam • Flammable Liquid Spill Fire Fighting and Vapor Suppression Control • Tank Fire Fighting • Refinery Fire Protection Systems • Gases • Hazards of Gases • Gas Emergency Control • Safety • Fire Fighting and Electricity • START Triage • Drill will include a scenario utilizing the ICS System. <i>See objectives</i> • <i>For further information see the Emergency Response Team Training Manual, Firefighter/hazardous Materials Technician.</i>
Drill Critique:	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	39 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ERT TRAINING AND DRILL GUIDELINE

	<ul style="list-style-type: none"> • <i>No Formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>
Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures.</i>
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures.</i> • Agency notification required for live fire training. All notifications must be documented. • The ERT Training Coordinator is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	40 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 19

EVACUATION DRILL GUIDELINE

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> Semi-annual/Shift
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 1 hour
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Refinery personnel
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Exercise evacuation and accountability procedures. Drill to be held on evenings or weekends
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Emergency Management will prepare format. Plant Shift Superintendent will conduct drill on shift.
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> OSHA
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> Drill only
Drill Critique:	<ul style="list-style-type: none"> Plant Shift Superintendent will critique drill performance and review with their respective group.
Training Review:	<ul style="list-style-type: none"> No review required; drill only.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> Training documentation and recordkeeping will be performed according to <i>approved documentation procedure</i>. Plant Shift Superintendent is responsible for completing documentation. Copy of documentation should be sent to Emergency Management Coordinator.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	41 OF 66
DOCUMENT NAME: Training and Exercise Plan			

APPENDIX 20

**FIRST RESPONDER AWARENESS TRAINING
(QUALIFICATION)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> ARTS CBT Training Other new hire training classes as required
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 4 – 24 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> HRO Maintenance, Technical and Admin personnel to be trained at the First Responder Awareness Level
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Hazwoper First Responder Awareness Qualification Basic knowledge and review of Emergency Action Plan Evacuation Plan review Employee Alarm Systems Hazard Communications training as required Recognize hazardous materials, the risk they pose, and the possible outcomes of a release. Identify released hazardous materials, if possible. Recognize the need for additional resources and notify the proper authorities of an incident/emergency. Basic decontamination principles and practices. Be able to provide site control if requested.
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> OSHA EPA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Training Department responsible for initiating training Emergency Management and Health and Safety are responsible for subject matter (Lesson Plans) formation, respectively
Required Training Topics: <i>Minimum specific training topics to meet required objective</i>	<ul style="list-style-type: none"> How to report an incident or emergency Identification of hazardous materials Hazardous properties of materials Classes of hazardous materials Emergency notification and response Site security and control Evacuation and personnel accounting procedures

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	42 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

**FIRST RESPONDER AWARENESS TRAINING
(QUALIFICATION)
GUIDELINE**

	<ul style="list-style-type: none"> • Emergency management organization • Civil disturbances • Bomb threat procedures
Drill Critique:	<ul style="list-style-type: none"> • No critique required, training only.
Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures</i>.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures</i>. • Operations/Maintenance Training is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	43 OF 66
DOCUMENT NAME: Training and Exercise Plan			

APPENDIX 21

**FIRST RESPONDER OPERATIONS TRAINING
(QUALIFICATION)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • New Operator Orientation and Initiation Training (NOOIT) • ARTS CBT Training (refresher)
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 4 – 24 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • HRO Operations personnel to be trained and certified at the First Responder Operations Level
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Hazwoper First Responder Operations Qualification • Basic knowledge and review of Emergency Action Plan • Evacuation Plan review • Employee Alarm Systems • Hazard Communications training as required • Recognize hazardous materials, the risk they pose, and the possible outcomes of a release • Identify released hazardous materials, if possible • Recognize the need for additional resources and notify the proper authorities of an incident/emergency • Be able to provide site control if requested
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • OSHA • EPA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Instructors: <ul style="list-style-type: none"> ⇒ Operations/Maintenance Training ⇒ Health and Safety ⇒ Emergency Management • Emergency Management and Health and Safety are responsible for subject matter (Lesson Plans) formation, respectively
Required Training Topics: <i>Minimum specific training topics to meet required objective</i>	<ul style="list-style-type: none"> • How to report an incident or emergency • Identification of hazardous materials • Hazardous properties of materials • Classes of hazardous materials • Emergency notification and response • Site security and control • Evacuation and personnel accounting procedures

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	44 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

FIRST RESPONDER OPERATIONS TRAINING (QUALIFICATION) GUIDELINE

	<ul style="list-style-type: none"> • Emergency management organization • Civil disturbances • Bomb threat procedures • Duties & Responsibilities • Fixed Fire Protection Systems • Fire Streams and Appliances • PPE • Basic Decontamination • Basic Fire, Spill, and Gas Release Control • Respiratory Protection
Drill Critique:	<ul style="list-style-type: none"> • No critique required, training only.
Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures</i>.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures</i> • Operations/Maintenance Training is responsible for completing all training documentation • Employee certification required

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	45 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 22

HOUSTON FIRE DEPARTMENT PREPLAN MEETING GUIDELINE

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Annual
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 4 Hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Emergency Management • Houston Fire Department
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Review HRO Emergency Action Plan. • Familiarize HFD Officers with HRO ICS. • Familiarize HFD Officers with HRO facilities, i.e., EOC, Field Command Post and Staging Areas. • Provide a basic understanding of refinery processes and equipment. • Continue building relationships between HRO and HFD Officers. • Provide a forum for communications and information exchange.
Compliance Required Objectives	<ul style="list-style-type: none"> • No
Compliance Group(s)	<ul style="list-style-type: none"> • N/A
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Facilitator: Emergency Management Coordinator
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • Topics for review to include: <ul style="list-style-type: none"> ⇒ Refinery Process and Equipment overview ⇒ Emergency Action Plan: <ul style="list-style-type: none"> * Incident Command System (ICS) * Outside Resource Management ⇒ Emergency Management Facilities <ul style="list-style-type: none"> * EOC * Field Command Post * CIMA Staging Areas ⇒ Facility tour and information
Drill Critique:	<ul style="list-style-type: none"> • No critique required, preplan meeting.
Training Review:	<ul style="list-style-type: none"> • No review required, preplan meeting only.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	46 OF 66
DOCUMENT NAME: Training and Exercise Plan			

HOUSTON FIRE DEPARTMENT PREPLAN MEETING GUIDELINE

Required documentation:
*Documentation required for
sessions*

- Agendas or other documents generated for or during the meeting will be properly filed.
- The Emergency Management Coordinator is responsible for completing all documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	47 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 23**MARINE SPILL DRILL - UNANNOUNCED
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Annual • <i>If an actual spill response is documented during the course of the year, then an unannounced drill is not required.</i>
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 8+ hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • ERT Marine Spill Team • Emergency Operations (EOC) • Emergency Response Command and Operations • Oil Movements Operations • Spill Control Contractor • May include Clean Channel member response teams • May include regulatory agencies such as USCG
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Full exercise to validate and test major aspects of Emergency Action Plans and Spill Response Plans • Facility spill boom deployment. • May exercise Clean Channel response plans. • Exercise notifications and plans with regulatory governmental organizations. • May deploy mutual aid association equipment. • Regulatory agency Spill Drill Credit received for this exercise.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	48 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

MARINE SPILL DRILL - UNANNOUNCED GUIDELINE	
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • EPA • USCG • DOT • TX GLO
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Exercise Coordinator: Emergency Management Coordinator • Assistant Exercise Coordinator: Assigned Environmental Engineer • The Exercise Coordinator is responsible for: <ul style="list-style-type: none"> ⇒ Managing the entire conduct operation. ⇒ Forming and organizing an Exercise Development Team. The team is responsible for designing, developing, conducting and evaluating the exercise. • The Development Team will be composed of refinery personnel. • The Exercise Coordinator will assign Development Team Members to subcommittees including but not limited to the following: <ul style="list-style-type: none"> ⇒ Control Team (Lead Controller and team members) ⇒ Evaluation Team (Evaluation Team Leader and team members). • Emergency Management is responsible for to prepare subject matter as required. <ul style="list-style-type: none"> ⇒ ERT Training Coordinator will coordinate and set up ERT Spill Team attendance.
Implementation Information	<ul style="list-style-type: none"> • Exercise should be developed in phases: <ul style="list-style-type: none"> ⇒ Development ⇒ Conduct ⇒ Evaluation ⇒ Follow-up • Requires 2 months planning • Requires expense budget considerations • Compliance exercise credit received from the following compliance groups: <ul style="list-style-type: none"> ⇒ USCG ⇒ TX GLO
Required Training Topics:	<ul style="list-style-type: none"> • The Exercise Development Team working will

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	49 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

MARINE SPILL DRILL - UNANNOUNCED GUIDELINE	
<i>Required minimum specific training topics to meet objective</i>	develop exercise scope to meet requirements for testing the respective emergency action plans.
Drill Critique:	<ul style="list-style-type: none"> • A formal critique according to incident critique procedures. <i>See Critique Procedures.</i>
Training Review:	<ul style="list-style-type: none"> • No training review required.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures.</i> • <i>For scenarios that include a Spill Equipment Deployment, documentation must include a completed Spill Deployment Exercise Form, Appendix 33: Spill Deployment Exercise Documentation.</i> • The Emergency Management Coordinator is responsible for completing all exercise documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	50 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 24

**NOTIFICATION DRILL
(WEEKLY)
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> Weekly
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> NA
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> HSE Security, Main Gate Dispatch Emergency Management Groups
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Performance testing and validating Meets requirements for Spill emergency response notifications. Meets requirements of the National Preparedness for Response Exercise Program (PREP) guideline for QI Notification Exercise.
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> EPA USCG TX GLO
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Security Supervisor is responsible for conducting drill as scheduled Emergency Management Coordinator ensures drills are performed and reviews completed documentation.
Required Topics: <i>Minimum specific topics to meet required annual objective</i>	<ul style="list-style-type: none"> The Main Gate Dispatcher will test primary and backup notification systems for all Emergency Alert Levels. Emergency Management Pager Groups will be tested according to their respective Response Classification.
Drill Critique:	<ul style="list-style-type: none"> No formal critique is required. The dispatcher will note any problems with the system in the comment section of the documentation form.
Training Review:	<ul style="list-style-type: none"> No review required
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> Documentation sent to HRO Library with monthly security reports. Copy of documentation sent to Emergency Management Coordinator. <i>For QI Notification Exercise documentation, complete Appendix 34: Notification Drill Weekly, QI</i>

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	51 OF 66
DOCUMENT NAME: Training and Exercise Plan			

**NOTIFICATION DRILL
(WEEKLY)
GUIDELINE**

Notification Exercise

- Security Supervisor is responsible for proper documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	52 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 25

ON-SCENE INCIDENT COMMAND TRAINING (QUALIFICATION) GUIDELINE

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> Annually or as needed
Hours <i>Estimated hours per session</i>	<ul style="list-style-type: none"> 16 - 40 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> Emergency Response positions including, but not necessarily limited to: <ul style="list-style-type: none"> ⇒ Field Coordinator ⇒ ER Command ⇒ ER Operations (Selected personnel) Prerequisite: Students should be Fire Fighter/Hazmat Technician qualified.
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> Hazwoper Level 5 qualification, On-Scene Incident Commander Classroom and possibly some practical application
Compliance Required Objectives	<ul style="list-style-type: none"> Yes
Compliance Group(s)	<ul style="list-style-type: none"> OSHA EPA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> Instructors: <ul style="list-style-type: none"> ⇒ Emergency Management ⇒ ERT personnel ⇒ Outside Instructors (As required) The ERT Training Coordinator will coordinate the school. ERT Training Coordinator is responsible for subject matter (Lesson Plans) formation.
Required Training Topics: <i>Minimum specific training topics to meet required objective</i>	<ul style="list-style-type: none"> Incident Command System (NIMS Compliant) Strategy and Tactics CIMA Incident Command System CIMA Procedures Hazardous Materials Response Planning Reporting Procedures (Agencies) Recognizing and Identifying Hazardous Materials Hazard Identification and Assessment Risk/Hazard Assessment Site and Scene Management Emergency Action Plan

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	53 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

ON-SCENE INCIDENT COMMAND TRAINING (QUALIFICATION) GUIDELINE

	<ul style="list-style-type: none"> • Toxicology • Decontamination • Monitoring and Surveying Equipment • Safety • Tabletop Drill to include a scenario utilizing the ICS System
Drill Critique:	<ul style="list-style-type: none"> • A group critique of the scenario will be performed after the drill. The objective of the critique is to evaluate strategic and tactical operations of the response discussing accepted performance areas and opportunities for improvement. • This critique exists as a learning performance tool for the response team. • <i>No formal critique documentation is required unless a global technique, procedural or equipment issue is identified.</i>
Training Review:	<ul style="list-style-type: none"> • Training review required according to <i>approved procedures</i>.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved procedures</i>. • The ERT Training Coordinator is responsible for completing all documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	54 OF 66
DOCUMENT NAME: Training and Exercise Plan			

APPENDIX 26**RESPONSE AND EVACUATION DRILL
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • Semi-annual • <i>If an actual response of Alert 2 or greater occurs during the course of the semi-annual period, then the drill is not required.</i> • Hosting the CIMA Zone Drill (Full Scale Exercise) will be substituted for one (1) semi-annual Response and Evacuation Drill.
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • 1 hours
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Refinery personnel • Refinery Emergency Management Groups
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Exercise to validate aspects of Emergency Action Plan: <ul style="list-style-type: none"> ⇒ Response ⇒ Notification ⇒ Communications ⇒ Evacuation and Accountability.
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • OSHA
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • Exercise Coordinator: Emergency Management Coordinator • The Exercise Coordinator is responsible for: <ul style="list-style-type: none"> ⇒ managing exercise, and ⇒ forming and organizing an <i>Exercise Development Team</i>. The team is responsible for designing, developing, conducting and evaluating the exercise. • The Development Team will be composed of refinery personnel. • The Exercise Coordinator will assign Development Team Members to subcommittees including but not limited to the following: <ul style="list-style-type: none"> ⇒ Control Team (Lead Controller and team members) ⇒ Evaluation Team (Evaluation Team Leader and team members). • Emergency Management is responsible for preparing subject matter and drill scenario as required.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	55 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

RESPONSE AND EVACUATION DRILL GUIDELINE

Implementation Information	<ul style="list-style-type: none"> • Exercise should be developed in phases: <ul style="list-style-type: none"> ⇒ Development ⇒ Conduct ⇒ Evaluation ⇒ Follow-up. • Dependent on the scenario, compliance exercise credit may be received from the following compliance groups: <ul style="list-style-type: none"> ⇒ USCG ⇒ EPA ⇒ DOT ⇒ TX GLO.
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • Exercise should include: <ul style="list-style-type: none"> ⇒ notification to Dispatcher, ⇒ notification to facility, ⇒ response of appropriate emergency management group, and ⇒ evacuation of respective personnel and reporting of accountability.
Drill Critique:	<ul style="list-style-type: none"> • Emergency Management will report results to management from Evaluator reports.
Training Review:	<ul style="list-style-type: none"> • No training review required.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • Training documentation and recordkeeping will be performed according to <i>approved documentation procedures</i>. • <i>For scenarios that include a Spill Equipment Deployment, documentation must include a completed Spill Deployment Exercise Form, Appendix 33: Spill Deployment Exercise Documentation.</i> • The Emergency Management Coordinator is responsible for completing all exercise documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	56 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 27**SCDI RESPONSE TEAM TRAINING
GUIDELINE**

Frequency: <i>Training frequency requirement</i>	<ul style="list-style-type: none"> • As scheduled <ul style="list-style-type: none"> ⇒ Transportation Hazardous Materials Specialist / Transloading Course every two years ⇒ DOT Certification and Media Relations every three years
Hours/Session: <i>Estimated hours per session</i>	<ul style="list-style-type: none"> • Varies
Group(s) involved: <i>Target Audience</i>	<ul style="list-style-type: none"> • Refinery SCDI Response Team Members
Objective: <i>General training objective(s)</i>	<ul style="list-style-type: none"> • Transportation Hazardous Materials Specialist • Transportation transloading practices • DOT Transportation Worker Certification • Effective media communication practices
Compliance Required Objectives	<ul style="list-style-type: none"> • Yes
Compliance Group(s)	<ul style="list-style-type: none"> • OSHA • DOT • LYO SCDI System
Implementation Group(s): <i>Instructor and coordinating groups preparing subject matter</i>	<ul style="list-style-type: none"> • LYO SCDI Manager
Required Training Topics: <i>Required minimum specific training topics to meet objective</i>	<ul style="list-style-type: none"> • As detailed by the training provider
Drill Critique:	<ul style="list-style-type: none"> • No critique required, training only
Training Review:	<ul style="list-style-type: none"> • Training review as required by SCDI Program.
Required documentation: <i>Documentation required for sessions</i>	<ul style="list-style-type: none"> • SCDI Program Manager is responsible for completing all training documentation.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	57 OF 66
DOCUMENT NAME: Training and Exercise Plan			

**APPENDIX 28
MARINE SPILL DEPLOYMENT EXERCISE
Documentation
Houston Refining LP**

**Drill/Exercise
Name:** _____

**1. Date Performed
:** _____

**2. Exercise or actual
Response?
If an exercise, announced or
unannounced?** _____

**3. Deployment location
(s):** _____

**4. Time
Started:** _____
**Time
Completed:** _____

5. Equipment deployed was:

_____	Facility-owned
_____	Oil spill removal organization-owned, if so which OSRO?
_____	Both

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	58 OF 66
DOCUMENT NAME: Training and Exercise Plan			

6. List type and amount of all equipment deployed and number of support personnel employed :

7. Describe goals of the equipment deployment and list any Area Contingency Plan strategies tested. (Attach a sketch of equipment deployments and booming strategies) :

8. For deployment of facility-owned equipment, was the amount of equipment deployed at least the amount necessary to respond to your facility's average most probable spill? :

Was the equipment deployed in its intended-operating environment?

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	59 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

9. For deployment of OSRO-owned equipment, was a representative sample (at least 1000 feet of each boom type and at least one of each skimmer type) deployed? :

Was the equipment deployed in its intended-operating environment?

10. Are all facility personnel that are responsible for response operations involved in a comprehensive training program, and all pollution response equipment involved in a comprehensive maintenance program? :

If so, describe the program:

Date of last equipment inspection:

11. Was the equipment deployed by personnel responsible for its deployment in the event of an actual spill?:

12. Was all deployed equipment operational? If not, why not? :

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	60 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

13. Identify which of the 15 Core Components of your Response Plan were exercised during this particular exercise:

- 1) Notifications
- 2) Staff Mobilization
- 3) Ability to operate within the response management system described in the
- 4) Discharge control
- 5) Assessment of discharge
- 6) Containment of discharge
- 7) Recovery of spilled material
- 8) Protection of sensitive areas
- 9) Disposal of recovered material and contaminated debris
- 10) Communications
- 11) Transportation
- 12) Personnel support
- 13) Equipment maintenance and support
- 14) Procurement
- 15) Documentation

14. Attach a description of lessons learned and person(s) responsible for follow up of corrective measures.

Date
:

Certifying Signature

Note: Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for USCG/RSPA) or for a minimum of 5 years (for EPA).

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	61 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 29
MARINE SPILL MANAGEMENT TEAM TABLETOP EXERCISE
Documentation
Houston Refining LP

1. Date Performed
:

2. Exercise or actual Response ?
If an exercise, announced or unannounced?

3. Tabletop Location (s):

4. Time Started:
Time Completed:

5. Response Plan scenario used:

_____ **Average most probable discharge**
_____ **Maximum most probable discharge**
_____ **Worst case discharge**
Size of the simulated spill _____ **bbls/gals**

6. Describe how the following objectives were exercised :

a) Spill management team's knowledge of oil-spill response plan:

b) Proper notifications:

c) Communications system:

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	62 OF 66
DOCUMENT NAME: Training and Exercise Plan			

d) Spill management team’s ability to access contracted oil spill removal organizations:

e) Spill management team’s ability to coordinate spill response with On-Scene Coordinator, state and applicable agencies:

f) Spill management team’s ability to access sensitive site and resource information in the Area Contingency Plan:

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	63 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

7. Identify which of the 15 Core Components of your Response Plan were exercised during this particular exercise:

- 1) Notifications
- 2) Staff Mobilization
- 3) Ability to operate within the response management system described in
- 4) Discharge control
- 5) Assessment of discharge
- 6) Containment of discharge
- 7) Recovery of spilled material
- 8) Protection of sensitive areas
- 9) Disposal of recovered material and contaminated debris
- 10) Communications
- 11) Transportation
- 12) Personnel support
- 13) Equipment maintenance and support
- 14) Procurement
- 15) Documentation

8. Attach a description of lessons learned and person(s) responsible for follow up of corrective measures.

Date

:

Certifying Signature

Note: Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for USCG/RSPA) or for a minimum of 5 years (for EPA).

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	64 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

APPENDIX 30
NOTIFICATION DRILL WEEKLY
QI Notification Exercise*
Documentation

NOTIFICATION DRILL (WEEKLY) QI Notification Exercise*		
Date		Dispatcher
Instructions		
Dispatcher to activate Emergency Notification Systems - Drill.		
Pager Notification Drill Message - 1st. Alternate Backup System (Backup Alpha-text Message System)		
Notification Drill: Alternate Backup System Emergency Management Pager System "ALL" Group. This is only a Drill. No response required.		
Pager Notification Drill Message – 2nd. Alternate Backup System (Numeric Paging Codes)		
777		
Emergency Management Pager Group Log		
Groups or Cap Code Group	Time issued	Remark/comment or time received
<i>Primary System</i>		
ENS Drill Message		
1st. Alternate Backup System (Backup Alpha-text Message System)		
Alert All		
2nd. Alternate Backup System (Numerical)		
Primary		
Secondary**		
ERT		

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	65 OF 66
DOCUMENT NAME:			
Training and Exercise Plan			

General Remarks/Comments	
Notification Confirmation from on site QI	
Dispatcher Signature	
<p><i>*The Notification Drill (Weekly) meets the requirements of the National Preparedness for Response Exercise Program (PREP) guidelines for QI Notification Exercise.</i></p> <p><i>**The HRO Qualified Individuals, the Plant Shift Superintendents, are included in the Emergency Management Pager Groups.</i></p>	

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	66 OF 66
DOCUMENT NAME: Training and Exercise Plan			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required.
All policy intent changes must be approved by the HSSE Manager.

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06/15/2011	Jeff Windham	Reformat	CM

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-012	Page: 1 OF 8	Approval Date:	06/30/2011
Document Title:	CRITIQUE & EVALUATION				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

The critique and the follow-up process is the evaluation phase of emergency response activities. This evaluation phase compares performance to expected actions and objectives. Evaluation offers a means to:

- collect data, analyze and document how participants understand and perform their designated response roles;
- compare performance to expected responses, objectives and performance criteria;
- assess the consolidated capabilities of teams and organizations; and
- ensure the continual improvement of emergency and crisis response capabilities by documenting strengths and areas for improvements.

The purpose of continuous improvement is to ensure that the lessons learned, corrective actions and areas of identified improvement are:

- integrated into the prevention, planning, training, quality assurance and future exercise considerations of the organization; and
- properly shared to maximize value throughout the organization.

This section provides the process and procedures for formal critiques.

CRITIQUE PROCESS

Informal critiques are routinely conducted by the Emergency Response and Operations personnel after training exercises and drills. Formal critiques shall be performed subsequent to the following:

- Actual emergencies classified as Alert 2 or greater responses.
- Emergency Response Exercises and Drills of a plant-wide nature.

Training and Exercise Guidelines located in the section titled *Emergency Management Training and Exercise Plan* provide direction on when to perform exercise and drill formal critiques.

- Actual emergencies, by the request of the HSSE Manager.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	2 of 8
DOCUMENT NAME: Critique & Evaluation			

Effective evaluation of emergencies and exercises is based on four (4) basic concepts:

- Observation
- Data collection
- Analysis
- Documentation and presentation of findings.

Observation

Observations are performed in order to collect data from an event.

Observations are collected by selected participants during emergencies. For exercises and drills, observations are collected by selected participants and evaluators.

Participants provide their perspective of an event during the course of actions. Evaluators are provided for exercises and drills to document response activities. Evaluators must have a working knowledge of response structures, plans and procedures.

Data Collection

Data is collected through various formats as described:

Logs and Documentation

Actual logs and documentation of the event should be collected for analysis. Logs and documentation provide valuable data on actions, tasks performed and their effectiveness. Documentation should include recorded times of performed actions.

Critique and Evaluation Form

A Critique and Evaluation Form has been established to collect information from selected participants and evaluators. Critique and Evaluation Forms must be completed following and no later than 24 hours after an event. The preferred method is to have a Debriefing Session immediately following the event. During the session, participants can discuss issues and collectively complete their forms. The Debriefing Sessions should be grouped to include, but may not be limited to, the following personnel:

- Emergency Operations (EOC)
- Emergency Operations - Manufacturing
- Emergency Operations - Field
- Emergency Response
- Evaluators (for exercises and drills only)

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	3 of 8
DOCUMENT NAME: Critique & Evaluation			

The Debriefing Session should be lead by the Emergency Operations Director for the Emergency Operations Group, and Emergency Response Command for the field groups

The Critique and Evaluation forms should be filled out by, but may not be limited to, the following emergency management personnel:

- All Coordinators and Staff personnel in EOC.
- The Field Coordinator and the Supervisor, Superintendent or Lead Operator of the affected unit.
- Emergency Response Command and the command staff personnel.
- Emergency Operations Chief, Division and other assigned officers.
- Evaluators (for exercises and drills only)

Consolidated forms from the various groups is acceptable.

All Documentation and Critique Forms shall be forwarded to the Emergency Management Coordinator.

See Attachment 1: Critique and Evaluation Form.

Data Analysis

The Emergency Management Coordinator will compile the collected data for analysis. The data will be analyzed in comparison with identified objectives and effectiveness of the response. The analysis should include sufficient detail to support whether internal standards as well as expectations of the groups are met.

For Exercises and Drills, the evaluators, as a committee, shall meet together for analysis of the information.

Documentation and Presentation of Findings

A Performance Report shall be prepared by the Emergency Management Coordinator. The report will present findings from critiques, evaluator assessments and other supporting documents. Issues reported should represent achievements and opportunities for improvement. Issues will be presented in general broad based terms.

The report is intended to provide feedback to management, the union and participants. A variation of the report may be provided facility-wide to promote lessons learned and areas of improvement.

These terms are intended to provide information to managers and all facility personnel in order to facilitate improvement activities. Prior to addressing these broad-based issues, no further item specific follow-up will be presented. Item closure will be represented with the issuance of this report to the facility.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	4 of 8
DOCUMENT NAME: Critique & Evaluation			

Future exercises and drills will provide on-going progress appraisals. As programs progress, prospective plans may include specific item recommendations and supporting follow-up actions as necessary.

Recommendation Tracking and Closure

Formal recommendations will be initiated when critique findings present significant improvement opportunities, or for which documentation of closure is required.

The Emergency Management Coordinator is responsible for entering recommendations into the company approved recommendation tracking system under the title "**Emergency Management**".

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	5 of 8
DOCUMENT NAME: Critique & Evaluation			

Appendix 1

CRITIQUE AND EVALUATION FORM					
Name of person completing form:			Emergency Management job position:		
Type of Critique:	<input type="checkbox"/> Emergency <input type="checkbox"/> Exercise/Drill	Position:	<input type="checkbox"/> Evaluator <input type="checkbox"/> Participant <input type="checkbox"/> Other	Functional Area:	<input type="checkbox"/> Emergency Operations (EOC) <input type="checkbox"/> Emergency Operations - Mfg <input type="checkbox"/> Emergency Operations - Field <input type="checkbox"/> Emergency Response
Name of Event or Exercise:					
Date and time of event:			Location (Unit or Area):		
Alert Level:	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> Other	Evacuation Level:	<input type="checkbox"/> No Evacuation <input type="checkbox"/> Non-Essential <input type="checkbox"/> All Personnel <input type="checkbox"/> Shelter in Place <input type="checkbox"/> Other	Type of Event:	<input type="checkbox"/> Fire <input type="checkbox"/> Gas Release <input type="checkbox"/> Spill <input type="checkbox"/> EMS <input type="checkbox"/> Rescue <input type="checkbox"/> Other
<p><i>Complete form as applicable to your position and functional area of responsibility. Please evaluate numerically based on performance. The index is as follows: "1" Poor, "2" Below average, "3" Average, "4" Good and "5" Excellent. "NA" means the issue was not applicable to your position or the event. Please list any comments as necessary per your response.</i></p>					
Subject	Issue		Comment		
Notification	Initiated properly by procedures		1--2--3--4--5 NA		
	Equipment functioned properly		1--2--3--4--5 NA		
Deployment of staff & equipment	Personnel responded per procedures.		1--2--3--4--5 NA		
	Equipment on scene as per procedure		1--2--3--4--5 NA		
	IC System implemented per event requirements		1--2--3--4--5 NA		
Emergency Plans	Operated within emergency plans and procedures		1--2--3--4--5 NA		
	Emergency information available and accurate		1--2--3--4--5 NA		
Life Safety	Evacuation initiated per procedures		1--2--3--4--5 NA		
	Notification systems (Evacuation) functioned properly.		1--2--3--4--5 NA		
	Evacuation site marked and safe		1--2--3--4--5 NA		
	Accountability and search accuracy and timeliness.		1--2--3--4--5 NA		
	Emergency responders life safety		1--2--3--4--5 NA		

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	6 of 8
DOCUMENT NAME:			
Critique & Evaluation			

<i>Incident Stabilization</i>	Exposure protection and containment control efforts.	1--2--3--4--5 NA	
	Fire extinguishment, elimination of hazard or discharge control	1--2--3--4--5 NA	
<i>Property Conservation</i>	Containment efforts	1--2--3--4--5 NA	
	Mitigation and recovery efforts	1--2--3--4--5 NA	
<i>Communication Systems</i>	Systems operated per procedures and properly.	1--2--3--4--5 NA	
	Systems and equipment adequate for traffic.	1--2--3--4--5 NA	
	Communications with mutual aid organizations	1--2--3--4--5 NA	
<i>HSE</i>	Required contacts proper and timely.	1--2--3--4--5 NA	
	Security of event maintained.	1--2--3--4--5 NA	
	On and Off-site monitoring efficient.	1--2--3--4--5 NA	
<i>Logistics</i>	Requested resources provided efficiently.	1--2--3--4--5 NA	
	Equipment and resources expedited timely.	1--2--3--4--5 NA	
<i>Human Resources</i>	Communications with employees.	1--2--3--4--5 NA	
	Communications with media and public.	1--2--3--4--5 NA	
	Management of affected personnel	1--2--3--4--5 NA	
	Effective, proper and timely contacts as required.	1--2--3--4--5 NA	
<i>Operations Planning & Support</i>	Planning efforts for refinery operation.	1--2--3--4--5 NA	
	Communications with operating areas	1--2--3--4--5 NA	
	Communications with other groups.	1--2--3--4--5 NA	
<i>Emergency Response Resources</i>	Equipment functioned properly.	1--2--3--4--5 NA	
	Equipment deployed proper for job.	1--2--3--4--5 NA	
	Mutual aid resource management	1--2--3--4--5 NA	
<i>Documentation</i>	Documentation accurate and adequate.	1--2--3--4--5 NA	

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	7 of 8
DOCUMENT NAME: Critique & Evaluation			

Using the questions above to facilitate your opinions, list two **LESSONS LEARNED** from this event:

(1)

(2)

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	8 OF 8
DOCUMENT NAME:			
Critique & Evaluation			

REVISION SUMMARY

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02/24/2011	Jeff Windham	Reformat	CM

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-013	Page: 1 OF 7	Approval Date:	06/30/2011
Document Title:	FIRE RESPONSE PLAN				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	05/15/2011	

The flammable and combustible nature of crude oil and its refined products pose a significant fire hazard to petroleum refining operations. In addition to process fire hazards, there are many structures, vehicles and pieces of machinery / equipment may become involved in a fire emergency.

This section provides procedures and guidelines specific to handling fires that occur within the boundaries of the Houston Refinery.

Some refinery streams, products and process chemicals may also pose a toxic hazard on contact with the skin or when inhaled. For emergencies requiring the use of specialized hazardous material PPE, techniques or equipment, see the EAP Hazardous Materials Response Plan.

MANAGEMENT OF FIRE EMERGENCIES

An emergency incident involving a fire requires the same reporting procedures as any other emergency within the refinery. The response level shall be commensurate with defined response classifications (Alert Levels) dependent on the significance of the event. Response of the Emergency Response Team is dictated by documented ERT Response Procedures. The Incident Command System (ICS) will be used for management of all fire scene emergencies.

If a major structure (e.g., office building, laboratory, storehouse or shop) is involved in a fire, an elevated alert level may be issued and Houston Fire Department may be requested for their structural firefighting expertise.

Refinery personnel trained on responses to fire emergencies shall report the fire immediately, and if possible may take safe actions to control or extinguish the fire using portable extinguishers, fire hose reels, steam lances and fixed fire protection systems.

As the Emergency Alert is issued and response personnel arrive, the scene will transition into the ICS management system for a fire scene.

Identification of Material Involved in the Fire

A fire in the refinery will often involve a hazardous material. As with any other hazardous materials emergency, identification of the materials involved is of primary concern in order to properly:

- provide strategic planning,
- assess the risks so that effective tactical actions can be taken,
- protect responders,
- protect the community.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	2 of 7
DOCUMENT NAME: FIRE RESPONSE PLAN			

The materials on fire must be identified in order to properly and safely provide rescue of personnel, treat exposed personnel, extinguish the fire and mitigate the fire scene of any residual material.

Several sources available to assist in materials identification are listed in the HSE-EAP-XXXX Hazardous Material Response Plan.

Strategy and Tactics

Basic strategies for fighting fires in the refinery involve both defensive and offensive approaches.

The defensive mode involves exposure protection and fire containment conducted from outside of the hazardous area. Exposure protection is undertaken to protect equipment not directly involved in the fire whereas containment efforts seek to prevent the fire from spreading to other areas.

An offensive attack involves extinguishing the fire or isolating the fuel source from within the hazard zone. For fires involving flammable and combustible liquids and gases, extinguishing is best performed by fuel removal. Extinguishing fires with fuel sources leaking may prove hazardous. Limiting the number and proximity of response personnel to the fire should be considered. When at all possible, fuel source isolations should be performed from a safe location, outside of the hazard zone. Aggressive attempts to stop leaks may be necessary when other efforts are not feasible.

Control of flammable liquid spills is best accomplished via a fast offensive foam application. This control method will limit exposures until consideration can be given to isolation of the fuel source.

Tactical considerations must always include life safety first. Proper evacuation, isolation, and control of the area are required. Emergency control and property conservation must be undertaken while taking into account life safety concerns.

Mitigation of Fire Scenes

After the emergency scene is secured, Command will consult with the Environmental Officer to determine what mitigation action will be taken. The owner or responsible Operations Area will assume the responsibilities for control/containment and mitigation actions in accordance with the Houston Refining SPILL RESPONSE AND PREVENTION PLAN (SRPP) with assistance from the Environmental Officer.

Procedures Involving Damaged Insulation

Much of the refinery piping and vessel insulation contains asbestos (Asbestos Containing Material, ACM). In the event of a fire or explosion, damage to insulation may create a potential for asbestos exposure.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	3 of 7
DOCUMENT NAME: FIRE RESPONSE PLAN			

The ICS Industrial Hygiene Officer should be consulted with regard to PPE and work practices required within areas where damage to ACM has occurred.

Outside Resources and Mutual Aid For Fire Response

Some fire incidents may require assistance from Houston Fire Department or Channel industries Mutual Aid. For procedures addressing outside resources and mutual aid for fire emergencies, see HSE-EAP-0014 Outside Resources and Mutual Aid.

Scene Control and Security

Tactical Divisions and Group Supervisors will coordinate with the Operations Section Chief or Command in establishing and monitoring incident scene control zones. Command will direct the incident Security Coordinator in establishing and monitoring a security zone around the perimeter of an incident. Control and Security Zones are necessary to:

- Keep non-essential personnel out of the Control Zones.
- Ensure that personnel entering the Control Zones have proper PPE.
- Ensure that proper decontamination is performed on personnel leaving the Hot Zone.

The concept of a Control Zone is illustrated in HSE-EAP-010 Hazardous Materials Response Plan, Appendix 2: Control Zones.

Information concerning incident scene security can be found in HSE-EAP-004 Emergency Incident Security and Control.

Marine Firefighting

Houston Refining has no official jurisdiction over any marine vessel. By State jurisdiction, the Port of Houston Authority has authority and uses the Houston Fire Department by contract for marine vessel firefighting. In the event of a fire on a marine vessel docked at the Refinery, Houston Refining will assist only at the request of the Ships Master, Owner, Port of Houston Authority, Houston Fire Department or Coast Guard.

Houston Refining does not maintain shipboard trained firefighters. Upon an appropriate request for assistance, Houston Refining ERT Members will only be committee to on deck operations and / or shore based assistance. The ship's Master, Captain or agent owner is in command of all operations of the vessel. Houston Refining will participate in a unified command with vessel agents and local authorities as required.

Houston Refining will take action to protect company owned docks and shore facilities in the event of a ship fire.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	4 of 7
DOCUMENT NAME: FIRE RESPONSE PLAN			

FIRE FIGHTING PERSONAL PROTECTIVE EQUIPMENT

All Houston Refining ERT members are provided with appropriate NFPA approved firefighting protective clothing to include:

- Turnout coat
- Turnout pants with boots
- Fire fighter's helmet
- Firefighter's protective hood, and
- Fire fighter's protective gloves

ERT Members receive training in the capabilities, donning procedures, and proper use of the bunker gear ensemble to include, as a minimum, the following:

- That turnout gear is designed to protect against temperature (steam, hot water, hot particles) and ordinary fire fighting hazards.
- The hazards and limitations of the equipment.
- That turnout gear may be used when:
 - ⇒ Contact with splashes of extremely hazardous material is unlikely.
 - ⇒ High levels of chemicals toxic to the skin are not present in the atmosphere of the incident vicinity.
 - ⇒ There are no adverse effects from chemical exposure to small-unprotected areas of skin.

Personal Protective Equipment (PPE) Requirements

Emergency Response personnel performing offensive firefighting activity or otherwise entering any fire area subject to changing conditions, which could be hazardous, shall be equipped with and use a minimum of full turnout gear and SCBA during the initial response phase of all fires and spills of volatile flammable, combustible or toxic products. Examples of such areas include but are not limited to:

- The battery limits of a processing unit experiencing working fire conditions
- The diked area of a tank or manifold fire / leak
- Any flammable / combustible liquid spill / fire area
- Any structure which has had a positive report of fire

These minimum PPE requirements will be required until industrial hygiene monitoring of the incident area identifies the necessary boundaries of a regulated / hot zone and the appropriate PPE levels for the hazards found. Those boundaries and PPE levels will then be communicated to all affected personnel.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	5 of 7
DOCUMENT NAME: FIRE RESPONSE PLAN			

In addition to full turnout gear and SCBA, Command may require other specialized protective equipment for specific hazards or for personnel involved in specific activities in defined areas.

Decontamination

Firefighter's protective ensembles shall be decontaminated upon product exposures.

Gross decontamination will be performed at the incident scene via fixed or temporary decontamination stations. Wash water shall be contained within fixed effluent systems or appropriate portable containers. See HSE-EAP-011 Hazardous Materials Response Plan, Decontamination of Personal Protective Equipment for additional information regarding on-site decontamination

After on-site decontamination efforts are complete, it may be necessary to send the equipment to a specialized vendor for more thorough decontamination. If this step is determined to be required, each individual set of gear shall be placed in an impervious bag at the scene. The gear shall not be re-used until returned from the vendor.

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	6 OF 7
DOCUMENT NAME:			

REVISION SUMMARY

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Date	Proposed By	Description of Change	Approved By/Date
05/15/2011	Jeff Windham	Reformat / Minor revisions	CM

DOCUMENT NO:	HSE-XXX-YYY	PAGE:	7 OF 7
DOCUMENT NAME:			

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HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-014	Page: 1 of 16	Approval Date:	06/30/2011
Document Title:	HAZMAT RESPONSE PLAN				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

Many emergencies in the Refinery involve hazardous materials which are flammable or combustible by nature and may be on fire. However, a spill or release of a hazardous material which may be toxic on contact with the skin or when inhaled is also a serious condition which emergency response groups must manage. This section provides procedures and guidelines specific to handling hazardous materials which require specialized equipment and techniques due to their toxic or corrosive nature.

The Emergency Response Team (ERT) under the leadership of the Hazmat Group shall provide specialized hazardous materials techniques and equipment. Specialized hazardous materials equipment shall only be used by personnel who have received proper training in their use.

Detailed requirements on prevention and response to spill events can be found in the site Spill Response and Prevention Plan

MANAGEMENT AND HANDLING OF SMALL SPILLS (INCIDENT)

An **incident** is limited in quantity, exposure potential, or toxicity.

Note: All incidents must be reported to main gate dispatch.
--

An incident poses no emergency or significant threat to the safety and health of employees in the immediate vicinity, even during clean up. A response to an incident can come from the immediate area utilizing equipment available in the area. Standard operating procedures can be followed for responding. Incidental spills that do not have the potential to develop into an emergency are covered under HAZCOM. MSDSs and HAZCOM manuals serve as a source for chemical-specific information. The environmental manual serves as a procedure and reference source.

Small spills can be handled by operations or maintenance personnel at the incident scene. This may include, but is not limited to, stopping and containing the leak or spill and picking up the material. These actions may only be taken if they can be accomplished with equipment readily available by individuals properly trained to perform the task.

When the personnel on the scene determine that control and mitigation require specialized equipment, techniques and training, an Emergency Alert shall be requested and activated. The Alert will summon the proper Emergency Response personnel to assist in managing the emergency.

DOCUMENT NO:	HSE-EAP-010	PAGE:	2 OF 16
DOCUMENT NAME: HAZMAT RESPONSE PLAN			

MANAGEMENT OF HAZARDOUS MATERIALS EMERGENCIES

An emergency incident involving a hazardous material spill or release requires the same reporting and will receive the same response as any other emergency. The Incident Command System (ICS) will be used for management of all hazardous materials emergencies. Responses shall be according to the Response Classifications (Alert Levels) for the respective type of emergency.

Identification of Hazardous Materials

At the scene of any hazardous materials emergency, the identification of the materials involved is of primary concern in order to properly:

- Provide strategic planning
- Assess the risks so that effective tactical actions can be taken
- Protect responders
- Protect the community

The product or material must be identified in order to properly and safely provide:

- Rescue of personnel
- Decontamination of personnel
- Treatment of exposed personnel
- Termination of the release or leak
- Proper mitigation of spilled material

Several sources available to assist in material identifications are listed in Appendix 1: **Identification of Hazardous Materials.**

Strategy and Tactics

Basic strategies for handling hazardous materials emergencies involve both defensive and offensive approaches.

The defensive mode involves containing the hazard to a respective area. This containing prevents further area contamination and limits exposures.

An offensive mode involves stopping the leak. Attempts should be made to stop leaks from as safe a location and distance as possible. Limiting the proximity of response personnel to the material should be considered. Aggressive attempts to stop leaks may be necessary when other efforts are not feasible. Aggressive offensives may also be necessary when other methods will not stop the leak in a timely enough manner to prevent further substantial hazards from occurring.

DOCUMENT NO:	HSE-EAP-010	PAGE:	3 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

Tactical considerations must always include life safety first. Proper evacuation, isolation and control of the area are required. Emergency control and property conservation must be undertaken while taking into account life safety concerns.

Mitigation of Hazardous Materials

After the emergency scene is secured, the Incident Commander will consult with the Environmental Officer to determine what mitigation action will be taken. The owner or responsible Operations Superintendent or Supervisor will assume the responsibilities for control/containment and mitigation actions in accordance with the Houston Refinery Spill Response and Prevention Plan (SRPP) with assistance from the Environmental Officer.

Fire Involving Hazardous Materials

Due to the presence of hazardous materials in the Refinery, it is possible that a fire or explosion may involve the release of significant volumes of hazardous materials. Hazardous material containers may also be exposed to fires, which could cause damage to the vessel and subsequent release of a hazardous chemical. Therefore, Command must determine whether or not a hazardous materials threat does in fact exist so that firefighters and others required to be on the incident scene can be equipped with the appropriate personal protective equipment.

See HSE-EAP-010 Fire Response Plan for more information on fire responses.

Procedures Involving Damaged Insulation

Much of the refinery piping and vessel insulation contains asbestos (Asbestos Containing Material, ACM). In the event of a fire or explosion, damage to insulation may create a potential for ACM exposure.

For procedures on handling damaged insulation, see the **HSE FIELD MANUAL, Procedure 15, Asbestos Abatement** and the **HSE COMPLIANCE PROGRAM AND PROCEDURE MANUAL, Asbestos Control Plan**

HAZMAT Group

See [Incident Command System & Organization HSE-EAP-007](#)

- Hazmat Group
- Entry
- Decontamination
- Site Access Control

Site Entry

The Hazmat Group or other tactical Divisions will coordinate with Command, the Operations Section Chief, Branch Directors and the Security Coordinator as necessary to establish and monitor Control Zones. Control Zones are necessary to:

DOCUMENT NO:	HSE-EAP-010	PAGE:	4 OF 16
DOCUMENT NAME: HAZMAT RESPONSE PLAN			

- Keep non-essential personnel out of hazardous areas and Control Zones.
- Ensure that personnel entering the Control Zones have proper PPE.
- Ensure that proper decontamination is performed on personnel leaving the Hot Zone.

The concept of a Control Zone is illustrated in [Appendix 2](#) and [Appendix 3](#)

For information concerning in plant and outside roadblocks, see HSE-EAP-004 Emergency Scene Security and Control

PERSONAL PROTECTIVE EQUIPMENT FOR HAZARDOUS CHEMICAL EXPOSURE

When exposure to hazardous materials is a possibility, response personnel shall wear appropriate personal protective equipment. Since hazardous chemicals vary widely in their characteristics, it is important to identify the chemical materials present and specify personal protective equipment suitable for the exposures possible. However, since this may not be immediately possible, the following shall be used as a guide to specify when emergency response personnel shall be required to wear chemical protective equipment.

For definitions which apply to all chemical personal protective equipment discussions, standards and other documentation as well as to this Emergency Action Plan see [Appendix 4](#)

Personal Protective Equipment Selection (PPE)

Chemical protective clothing (CPC) shall be selected based on the level of protection needed. If specialized levels of personal protective equipment are required, the Hazmat Group will coordinate with the Safety and Industrial Hygiene (IH) Officers to determine the best options.

Compatibility of the involved chemical with the material of the chemical suit (and gloves) shall be determined and considered in selecting of chemical protective clothing, preferably using the compatibility chart of the manufacturer of the clothing.

When working with flammable gases or flammable liquids, flash protection shall be provided by either a flash protective over-garment or by employing other protective measures.

Cooling vests will be worn at the discretion of the wearer of encapsulated protective clothing or the Hazmat Group Supervisor in charge.

See [Incident Command System & Organization HSE-EAP-007](#)

- Industrial Hygiene Officer
- Safety Officer

DOCUMENT NO:	HSE-EAP-010	PAGE:	5 OF 16
DOCUMENT NAME: HAZMAT RESPONSE PLAN			

Levels of Protection

The four levels of protection which may be required and the requirements governing the selection of equipment to meet each level are as follows:

- Level A Protection - Selected when the highest level of protection to skin, eyes and respiratory system is needed. Level A protection consists of SCBA and encapsulated protective clothing.
- Level B Protection - Selected when the highest level of respiratory protection is needed, but a lesser level of skin protection is needed. Level B protection consists of SCBA and encapsulated or non-encapsulated protective clothing.
- Level C Protection - Selected when the criteria for using air-purifying respirators are met. Level C protection consists of air purifying respirator and non-encapsulated protective clothing. Level C protection shall not be selected except where the atmosphere is monitored and levels of airborne substances meet the criteria for air purifying respirators.
- Level D Protection - Used only when the site has no respiratory or skin hazards. Level D protection consists of work Nomex uniform with head and eye protection.

Additional detail information on PPE may be found in the **EMERGENCY RESPONSE TRAINING MANUAL**.

PPE Donning and Doffing

Encapsulated Protective Clothing

The following rules shall be observed during donning and doffing of encapsulated protective clothing. Refer to the **EMERGENCY RESPONSE TRAINING MANUAL** for detailed information on the donning and doffing procedure.

- Encapsulated protective clothing shall be given a visual inspection prior to use.
- Donning and doffing encapsulated clothing shall be in accordance with industry and manufacturer's standards.
- A helper shall be employed to assist in the donning and doffing of encapsulated protective clothing.

Non-encapsulated Protective Clothing

The following rules shall be observed during donning and doffing of non-encapsulated protective clothing.

DOCUMENT NO:	HSE-EAP-010	PAGE:	6 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

- Non-encapsulated protective clothing shall be given a visual inspection prior to use.
- The type of non-encapsulated protective clothing shall determine the method of donning and doffing.
- Openings in non-encapsulated protective clothing shall be taped when liquid or vapor contact with the skin is possible.

Self Contained Breathing Apparatus (SCBA)

Donning and doffing SCBA shall be in accordance with the Refinery's SCBA Training Course, and shall follow the manufacturer's specifications and recommendations.

The level of respiratory protection may be downgraded to air purifying respirators after air monitoring results confirm that all criteria for this type of respirator are met.

Personal Protective Equipment Use

Personal protective equipment must be used and operated under certain accepted safe procedures. Command, the Operations Section Chief, Branch Director, and the Hazmat Group Supervisor are responsible for ensuring safe operating procedures are followed.

The following procedures shall be followed when chemical protective clothing is in use:

- Personnel wearing chemical protective clothing and operating in the hot zone shall work in pairs.
- At least one team shall back up each operating team working in chemical protective clothing in the hot zone. The level of protection for back up personnel shall be equal to that of the operating team.
- Back-up personnel should keep the operating team in view and shall remain alert to a call for assistance.
- Each operating team shall have radio communication when working in encapsulated protective clothing.
- Chemical protective clothing which has a poor degradation rating or rapid breakthrough time for the chemical being handled shall be decontaminated and removed immediately after receiving a severe liquid splash or vapor exposure.
- All personnel in chemical protective clothing shall leave the hot zone via the decontamination corridor.
- Eye protection is mandatory when operating in the hot zone, either by SCBA, splash goggles or safety glasses.

Work Mission Duration

Continuous time of work by personnel wearing encapsulated protective clothing shall be limited to the duration of a one-hour air cylinder, minus the time needed to exit the hot zone

DOCUMENT NO:	HSE-EAP-010	PAGE:	7 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

and complete the decontamination procedure. The actual permitted work duration shall be established by Command. A shorter duration may be specified. Personnel shall leave a hazard zone at the first symptom of any distress. Types and symptoms of distress are listed in [Appendix 5](#)

Personnel Monitoring for Encapsulated Chemical Protective Clothing (CPC)

Personnel encapsulated in protective clothing are subject to various physical and physiological constraints; hence they shall be monitored continuously. Monitoring procedures to be followed when personnel are utilizing fully encapsulated CPC are as follows:

- Personnel in encapsulated protective clothing shall be monitored by back-up personnel and by radio communication.
- The **time shall be recorded** when personnel are enclosed in encapsulated protective clothing, and the personnel encapsulated shall be notified after an elapsed time of 30 minutes, and at five minute intervals thereafter.
- When ambient temperature exceeds 70 degrees, the wearer of encapsulated protective clothing without cooling vests shall be notified after an elapsed time of 20 minutes, and at five minute intervals thereafter.
- Heart rate and body temperature of personnel wearing encapsulated protective clothing shall be measured and recorded upon leaving the hot zone and again before re-entering the hot zone in encapsulated protective clothing.
- Personnel shall not be permitted to return to the hot zone in encapsulated protective clothing when:
 - ⇒ The heart rate exceeds 110 beats per minute (measured by the radial pulse for 30 seconds) or exceeds the maximum heart rate established for the individual.
 - ⇒ The body temperature exceeds 99 degrees Fahrenheit.

Decontamination

Decontamination shall be established as necessary where chemical protective clothing is worn. The specific decontamination procedure used shall be specified by Command with the concurrence of the IH Officer. As required, a Decontamination Unit Leader will be assigned by the Hazmat Group to direct the decontamination process.

The following rules shall be followed in the decontamination of personal protective equipment after hazardous chemical exposure.

- The decontamination area must be located upwind and uphill of the hot zone.
- All personnel leaving the hot zone shall exit via the decontamination corridor and shall be thoroughly decontaminated before removing chemical protective clothing.

DOCUMENT NO:	HSE-EAP-010	PAGE:	8 OF 16
DOCUMENT NAME: HAZMAT RESPONSE PLAN			

- Disposable or limited use CPC shall be decontaminated and properly prepared for disposal at the incident site.
- SCBA which came in contact with liquid or vapor at a hazardous materials incident shall be decontaminated and returned to the Safety Supply for a thorough inspection.
- Personal protective equipment that cannot be decontaminated to an acceptable level shall be disposed of in accordance with hazardous waste handling policies and procedures, and with state and federal laws.
- All contaminated water from the decontamination procedure shall be collected, tested and disposed of using established procedures.

[Attachment 6: Nine Step Decon Procedure](#) shows the steps in the decon procedure and describes the actions taken in each step. The attachment also shows a typical decontamination area setup.

Further detailed training information is listed in the **EMERGENCY RESPONSE TEAM TRAINING MANUAL, Decontamination**.

For procedures on decontamination and transportation of injured or exposed personnel, see [EMERGENCY MEDICAL SERVICES PLAN HSE-EAP-011, Decontamination of Exposed Personnel](#) in this volume.

PPE TRAINING AND RESPIRATOR FIT TESTING

PPE training is included in the normal training provided all ERT personnel. Refer to the **EMERGENCY RESPONSE TEAM TRAINING MANUAL** for additional detail.

Respiratory fit testing will be performed annually on Emergency Response, ERT and other essential (e.g., Operations and other support) personnel by the HSE Department. See **HSE FIELD MANUAL** for further detail.

DOCUMENT NO:	HSE-EAP-010	PAGE:	9 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

APPENDIX 1 IDENTIFICATION OF HAZARDOUS MATERIALS

- **OCCUPANCY AND LOCATION**
 - ⇒ Unit or process area?
 - ⇒ Building, warehouse or shipping area?
 - ⇒ Manufacturing area?
- **HAZCOM INFORMATION**
 - ⇒ Process Flow diagrams
 - ⇒ Material Safety Data Sheets
 - ⇒ Unit Inventories
- **PROCESS INFORMATION**
 - ⇒ Information from Operations personnel
 - ⇒ Process and Instrumentation Diagrams (P&ID)
 - ⇒ Operations procedures
- **CONTAINER TYPE AND SHAPE**
 - ⇒ Type of process vessel; e.g., drum, pressure vessel, tower, accumulator, etc.
 - ⇒ Type and shape of tank car or truck.
 - ⇒ Type of storage tank; e.g., sphere, bullet tank, floating roof tank, etc.
 - ⇒ Type of storage container; e.g., cylinder, carboy, bulk package.
- **MARKINGS, LABELS, COLORS AND PLACARDS**
 - ⇒ Design of labels on package showing dangers.
 - ⇒ Proper name (label)
 - ⇒ Design, color and symbol designating hazard and hazard class (labels and placards)
 - ⇒ Worded or number placards
 - ⇒ Color or marking on container
 - ⇒ NFPA 704 System
- **SHIPPING PAPERS**
 - ⇒ Invoices
 - ⇒ Way bills
 - ⇒ Bill of lading
 - ⇒ Manifests
 - ⇒ Air Bills
- **RESOURCES**
 - ⇒ Reference manuals
 - ⇒ DOT Emergency Response Guidebook
 - ⇒ CHEMTREC
 - ⇒ Emergency contact for manufacturer or generator of the material
- **SENSE PERCEPTION**

This means to look and always be alert.

DO NOT TOUCH OR SMELL PRODUCT TO ATTEMPT TO IDENTIFY THEM

 - ⇒ Visual observations
 - ⇒ Olfactory sensing

DOCUMENT NO:	HSE-EAP-010	PAGE:	10 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

CHEMTREC
Chemical Transportation Emergency Center
1-800-424-9300

DOCUMENT NO:	HSE-EAP-010	PAGE:	11 OF 16
DOCUMENT NAME: HAZMAT RESPONSE PLAN			

APPENDIX 2 CONTROL ZONES

- **HOT ZONE** (also known as the Exclusion or Restricted Zone)
 - ⇒ Spill or contaminated area.
 - ⇒ Access limited to personnel necessary to control the incident.
 - ⇒ Boundary lines should be delineated by hazard tape or signs.
 - ⇒ Depending on task there may be different levels of protection in the Hot Zone.

- **WARM ZONE** (also known as the Decontamination or Contamination Reduction Area)
 - ⇒ Personnel and equipment decontamination.
 - ⇒ Reduces spread of contamination.
 - ⇒ Severity of contamination should decrease as one moves through the area.

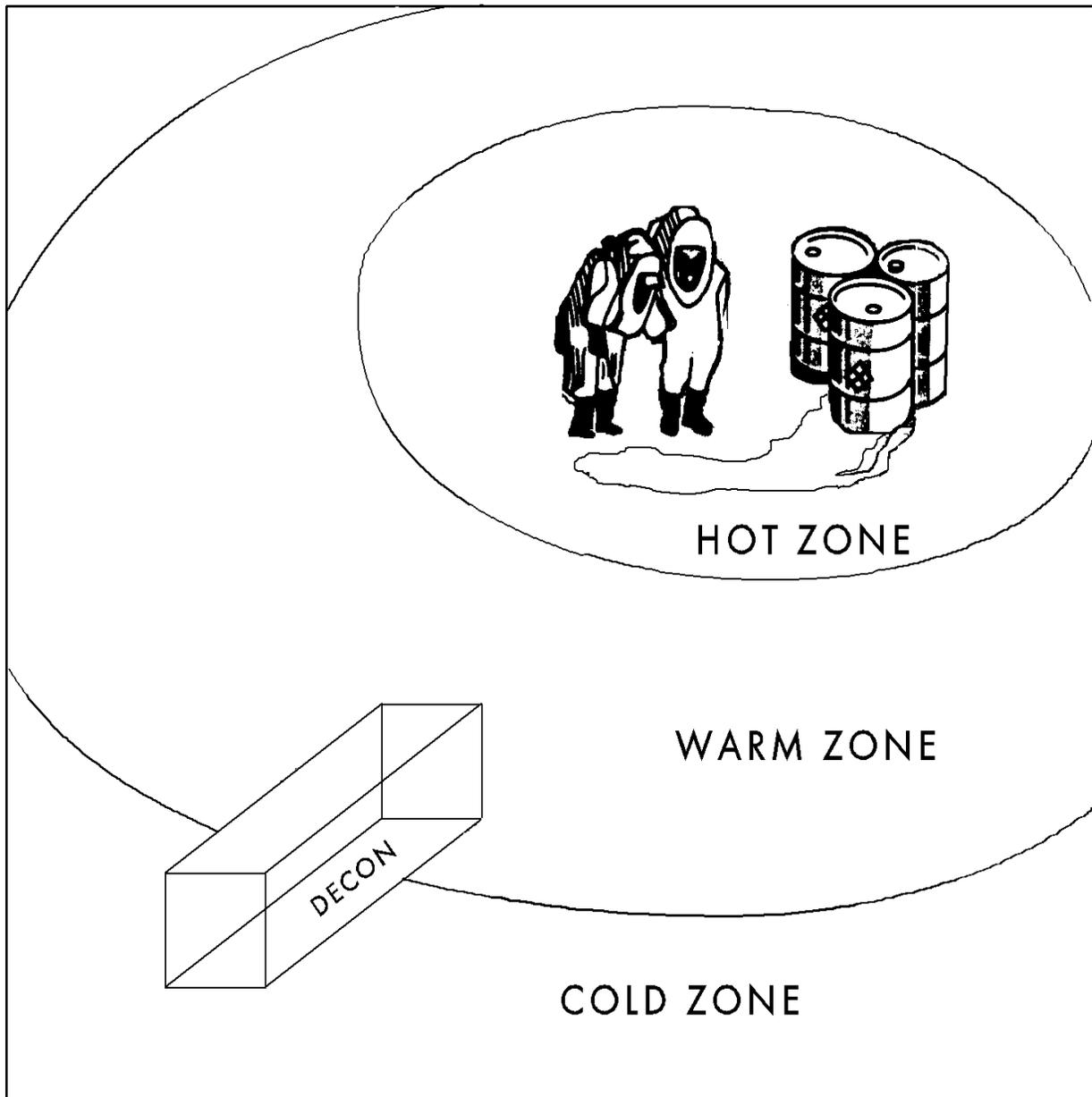
- **COLD ZONE** (also known as the Clean or Support Zone)
 - ⇒ Field Command Post location.
 - ⇒ No specialized PPE required.

DOCUMENT NO:	HSE-EAP-010	PAGE:	12 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

APPENDIX 3

CONTROL ZONES SURROUNDING A SPILL

- Decontamination in the WARM ZONE
- The Decon Area must be located upwind and uphill from the HOT ZONE



DOCUMENT NO:	HSE-EAP-010	PAGE:	13 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

APPENDIX 4

DEFINITIONS FOR PERSONAL PROTECTIVE EQUIPMENT FOR HAZARDOUS CHEMICAL EXPOSURE

- **Chemical Protective Clothing (CPC)** -- Special clothing made of materials which resist chemical degradation and chemical permeation; includes encapsulated protective clothing, non-encapsulated protective clothing, gloves and boots.
- **Decontamination Corridor** -- An area in which decontamination is established; the corridor abuts the Hot Zone.
- **Encapsulated Protective Clothing** -- Chemical resistant clothing which, when used with SCBA, offers full body protection against chemical vapors, gases, liquids and particulates.
- **Flash Protective Overgarment** -- Garments made of fire-resistive materials which are worn with chemical protective clothing to protect the wearer against a flash fire.
- **Non-encapsulated Protective Clothing** -- Chemical protective clothing that offers protection against liquid splashes of skin-affecting chemicals; includes common splash suits and disposable chemical protective clothing.
- **Over-gloving** -- The use of two pairs of chemical resistant gloves, one pair worn over the other, for double protection against chemical contact.
- **PPE** -- Personal Protective Equipment.
- **SCBA** -- Self Contained Breathing Apparatus.

DOCUMENT NO:	HSE-EAP-010	PAGE:	14 OF 16
DOCUMENT NAME: HAZMAT RESPONSE PLAN			

APPENDIX 5

SIGNS OF DISTRESS ASSOCIATED WITH USE OF CHEMICAL PROTECTIVE CLOTHING

Types of distress and their respective symptoms include:

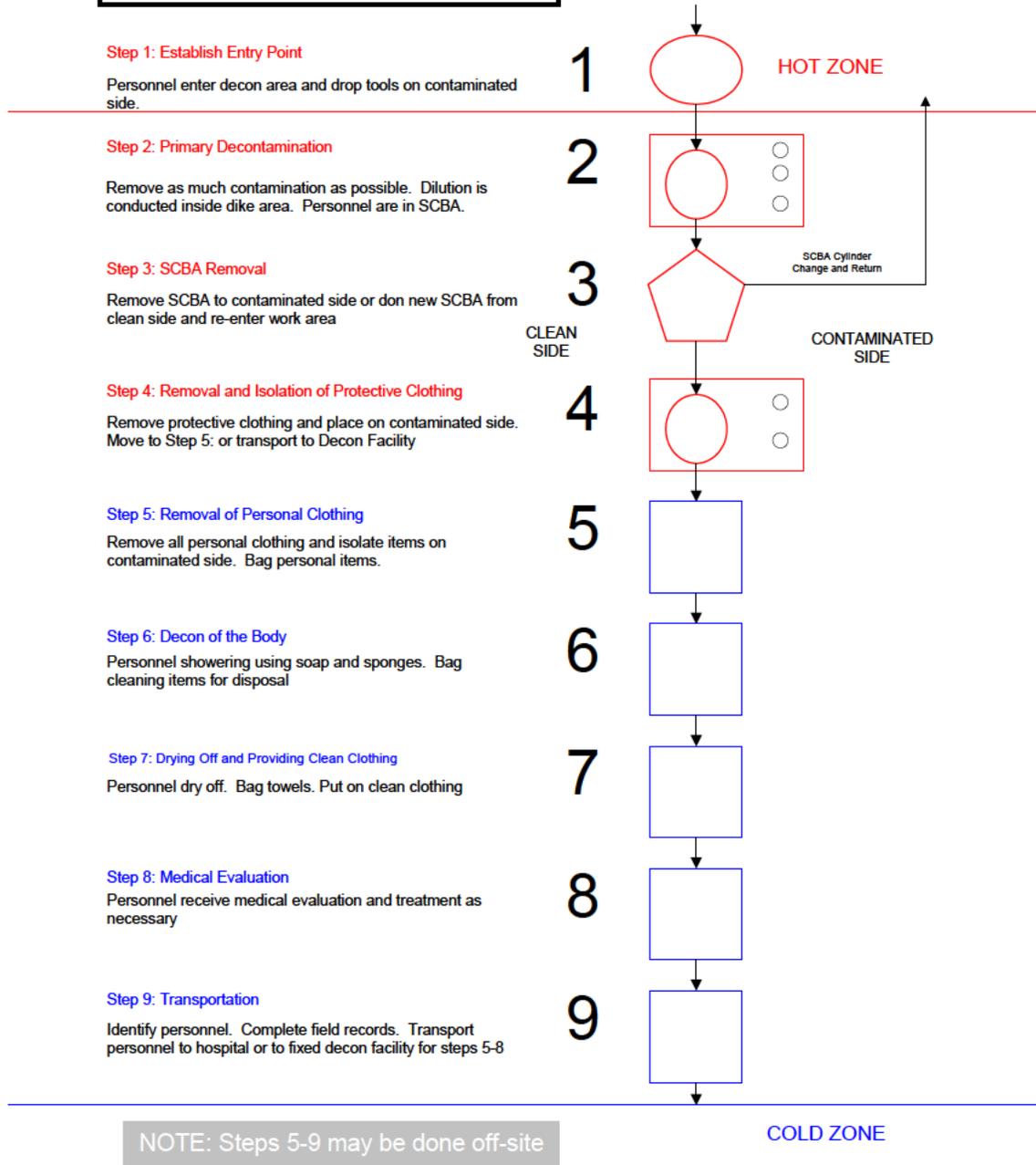
- **Chemical Distress:**
 - ⇒ Headache
 - ⇒ Dizziness
 - ⇒ Blurred vision
 - ⇒ Cramping
 - ⇒ Irritation of eyes, skin and respiratory tract

- **Heat Distress:**
 - ⇒ Muscle spasm
 - ⇒ Pain in extremities or abdomen
 - ⇒ Dizziness
 - ⇒ Lethargic/listless
 - ⇒ Nausea

A rest period will be required for wearers of encapsulated protective clothing after each mission.

DOCUMENT NO:	HSE-EAP-010	PAGE:	15 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

**ATTACHMENT 6:
NINE (9) STEP DECON PROCEDURE**



DOCUMENT NO:	HSE-EAP-010	PAGE:	16 OF 16
DOCUMENT NAME:			
HAZMAT RESPONSE PLAN			

REVISION SUMMARY

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Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-015	Page: 1 OF 7	Approval Date:	06/30/2011
Document Title:	EMERGENCY MEDICAL SERVICES PLAN				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

Many times, emergencies within the refinery involve injuries or illnesses. These situations warrant the Emergency Medical Services (EMS) training of the Rescue Team. The purpose of EMS is to provide early access, initial care, and to arrange for transportation of a patient to an appropriate medical facility. The Rescue Team portion of the Emergency Response Team (ERT) will carry out these actions.

MANAGEMENT OF MEDICAL EMERGENCIES

When a Medical Emergency occurs, the equipment and personnel respond according to the Response Classification (Alert Level). The Incident Command System (ICS) is implemented, as in other types of emergencies, and a Medical Group Supervisor may be assigned. The Medical Group may delegate the following team leader positions according to the size and severity of the scene: Triage, Medical Treatment, Transportation, Air Operations, and Rescue.

Treatment

Each member of EMS has been properly trained in Emergency Medicine and is following physicians' orders. The procedures can be found in the Houston Refinery **EMS BASIC AND ADVANCED EMERGENCY MEDICAL CARE, PROCEDURES, PROTOCOLS AND ORDERS**. Protocols are indirect orders signed by the Plant Medical Director to help establish a uniform standard of care within the refinery.

Transportation

Patients requiring outside medical assistance will be transported off site to an appropriate medical facility. Patients will be transported by one of three options. When appropriate, the Houston Refinery ambulance, Medic 1, will be utilized to transport to the appropriate facility. When necessary, both the Houston Fire Department and Hermann Life Flight may be utilized. Criteria for use of all of these resources are available in the Houston Refinery EMS Response Procedures.

DOCUMENT NO:	HSE-EAP-011	PAGE:	2 OF 7
DOCUMENT NAME:			
EMERGENCY MEDICAL SERVICES PLAN			

MASS CASUALTY INCIDENT

Major emergencies in the refinery may involve injuries to large numbers of people. It is important to handle each patient in a rapid and effective manner. The picking and choosing of patients according to the severity of injuries and illness of the patient is called Triage. The method accepted by the EMS is termed Simple Triage and Rapid Treatment (START). Using triage tags with a color-coded system allows patients to be evaluated and placed in one of four categories for treatment and transportation purposes. See the following:

[Attachment 1: START Triage.](#)

[Attachment 2: Triage Tag.](#)

[Attachment 3: Medical Transportation Plan.](#)

[Outside Resources and Mutual Aid HSE-EAP-014](#)

Medical Group

See [Emergency Response – Operations Chief: HSE-EAP-007](#)

- Medical Group
- Medical Group, job function
- Triage, job function
- Medical Treatment, job function
- Transportation, job function
- Air Operations, job function
- Rescue, job function

DECONTAMINATION OF EXPOSED PERSONNEL

Patients involved in hazardous material incidents must be properly decontaminated before being transferred to outside personnel or facilities. Patient decon should be done at the incident scene whenever possible. If the patient is unable to be properly decontaminated at the scene, he/she should be taken to the Houston Refinery Medical Facility for further decontamination. A Decon Leader may be present for large Hazmat incidents. In these cases, patients should go through the decontamination process as established in [HSE-EAP-010 Attachment 6: Nine Step Decon Procedure](#) located in the **Hazardous Materials Response Plan**.

It is important to remember that some patients cannot be totally decontaminated before leaving the facility to receive further treatment. Special steps should then be taken to protect the equipment, ambulance, and personnel coming in contact with these patients. EMS personnel should wear necessary personal protective equipment to ensure the lowest possible exposure. The exposed patient shall be accompanied with the proper MSDSs to be given to the transporting EMS service or Receiving Facility. Although patient decon is one of the responsibilities of both the HAZMAT and EMS, it is ultimately the responsibility of Command to ensure that all patients and responding personnel are decontaminated.

DOCUMENT NO:	HSE-EAP-011	PAGE:	3 OF 7
DOCUMENT NAME: EMERGENCY MEDICAL SERVICES PLAN			

Following contact with a contaminated patient, the incident scene, ambulance, and all exposed equipment should be properly decontaminated

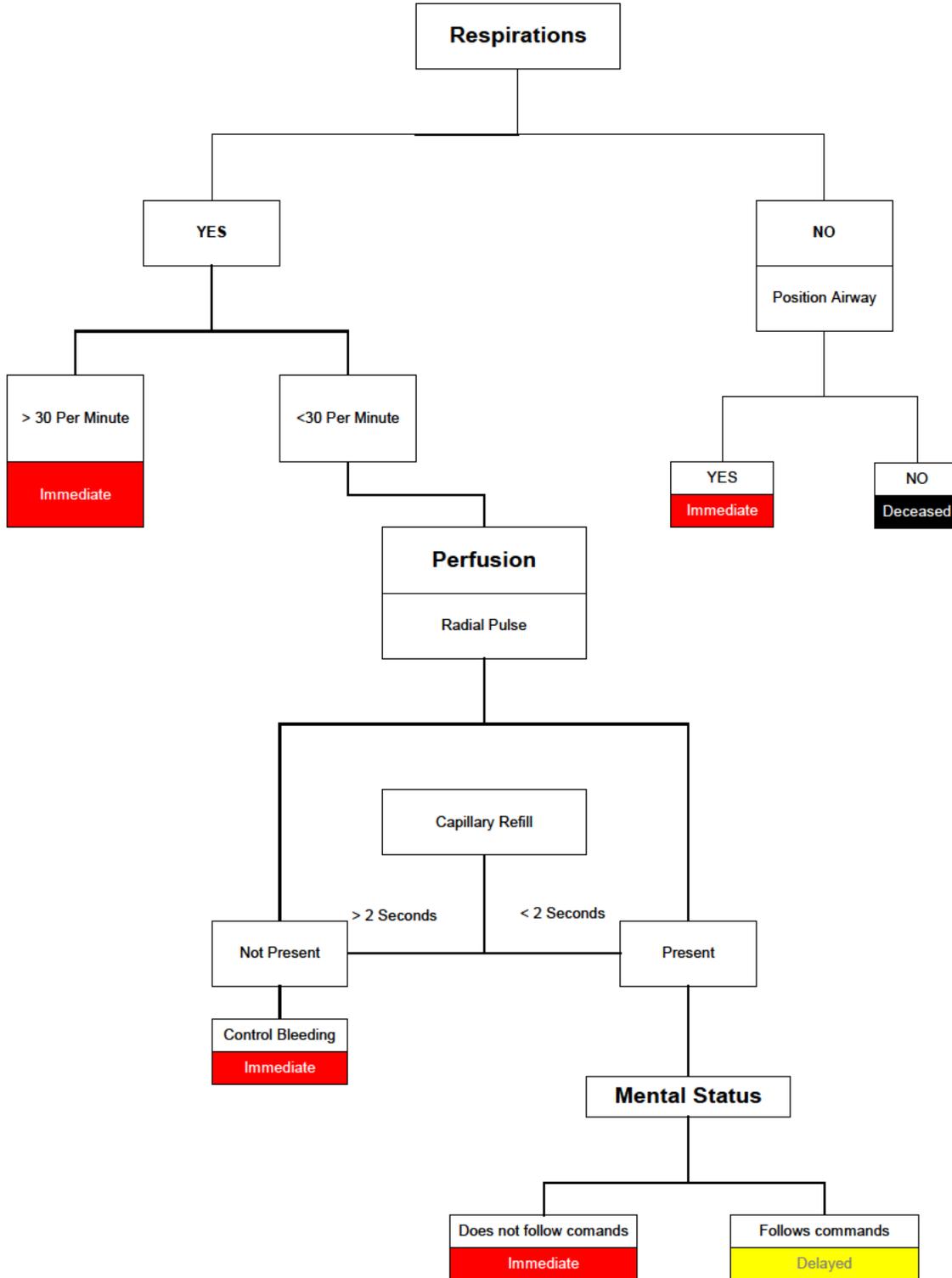
Members of the Emergency Response Team (ERT) shall assume at all times that any patient's blood or body fluids are infectious of HIV, HBV, or other pathogens. This assumption helps ensure that established work practices are followed, personal protective equipment is worn, and biological waste is handled appropriately. Employees exposed to another person's blood or body fluids while conducting their job duties shall report the exposure to the Medical Department. Exposure can be by needle sticks, cuts, abrasions or human bites, among others. All proper work practices and housekeeping practices shall be utilized at all times.

If it is deemed appropriate, responders and patients should also utilize precautions against airborne pathogens such as Tuberculosis.

For the Bloodborne Pathogen Program and associated universal precautions, See [Bloodborne Pathogen Program located in H&S Manual.](#)

DOCUMENT NO:	HSE-EAP-011	PAGE:	4 OF 7
DOCUMENT NAME:			
EMERGENCY MEDICAL SERVICES PLAN			

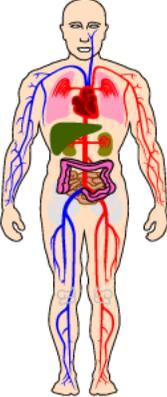
**Attachment 1:
START Triage**



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DOCUMENT NO:	HSE-EAP-011	PAGE:	5 OF 7
DOCUMENT NAME:			
EMERGENCY MEDICAL SERVICES PLAN			

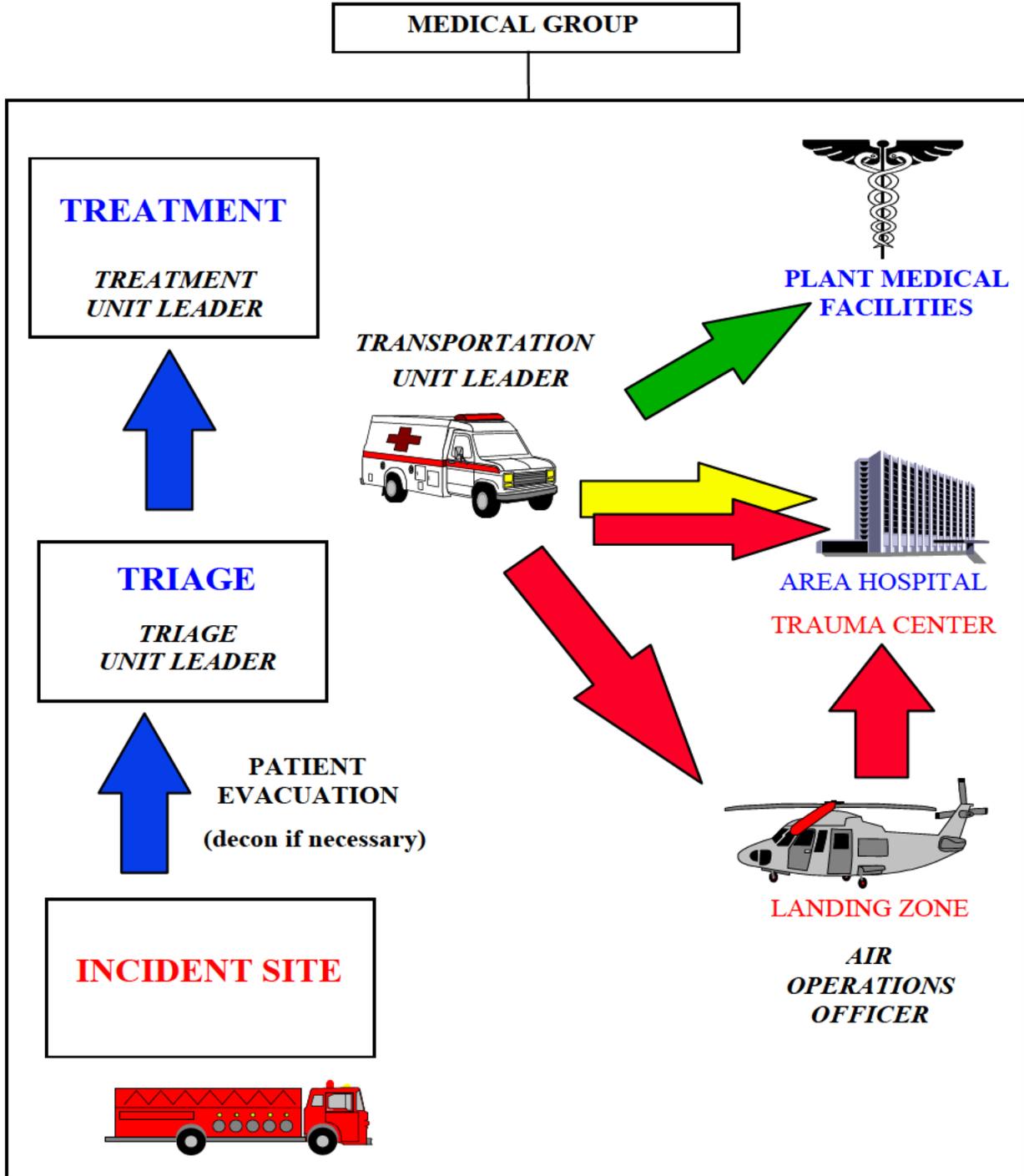
**ATTACHMENT 2:
TRIAGE TAGS**

LHR TRIAGE TAG		00132
NAME	AGE	SEX
LYONDELL CITCO REFINING CO. LTD. 12000LAWNDALE, HOUSTON, TEXAS 77017		
OTHER INFORMATION		
	Respiratory	
	Shock	
	<input type="checkbox"/> 1. Bleeding	_____
	<input type="checkbox"/> 2.. Burns	_____
<input type="checkbox"/> 3. Fracture	_____	
HOSPITAL/DESTINATION		TIME
		1230
TRANSPORTED BY		PRIORITY
TIME	RECORD ALL DIAGNOSIS AND TREATMENT	
P U L S E	R E S P	B P
P-1 IMMEDIATE		
P-2 DELAYED		
P-3 MINOR		

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DOCUMENT NO:	HSE-EAP-011	PAGE:	6 OF 7
DOCUMENT NAME:			
EMERGENCY MEDICAL SERVICES PLAN			

**ATTACHMENT 3:
MEDICAL TRANSPORTATION
PLAN**



DOCUMENT NO:	HSE-EAP-011	PAGE:	7 OF 7
DOCUMENT NAME:			
EMERGENCY MEDICAL SERVICES PLAN			

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Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-016	Page: 1 OF 4	Approval Date:	06/30/2011
Document Title:	RESCUE RESPONSE PLAN				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

In some cases, emergencies within the refinery may involve Confined Space, High Angle, or other heavy rescue efforts. These situations warrant the specialized training, tactics, and equipment of a Rescue Team. The Rescue Team's purpose is to extricate patients who are entrapped or unable to remove themselves from a dangerous situation.

NOTIFICATION

When a Rescue situation occurs within the refinery, the equipment and personnel respond according to the Response Classification (Alert Level).

RESCUE

See [Emergency Response - Operations](#): Rescue: Roles and Responsibilities
Medical: Roles and Responsibilities

MANAGEMENT OF RESCUE OPERATIONS

The Incident Command System (ICS) is implemented and a Rescue Group Supervisor or Rescue Team Leader may be assigned.

Rescue Operations - General Procedures

- Emergency Response - Command (Command) may conduct a brief team meeting for the purposes of developing a strategic plan for the emergency or implementing a pre-plan where appropriate.
- Command may establish a **Safety Officer** position when personnel are available to stop and correct any unsafe acts, but may not modify the strategic plan.
- Command shall designate a **Hole Watch** for all confined space emergencies.
- No Rescue equipment shall be used in a manner inconsistent with the recommendations of the manufacturer.
- Consistent with the current requirements of NFPA 1983, all "**Main Lines**" shall be rigged with "new" (unused) rope.
- Cranes, hoists, and cherry pickers shall not be used to transport rescue personnel or patients unless all requirements of the applicable OSHA standards are met. Their use as "**elevated anchor points**" shall be permitted where other means are not available.

DOCUMENT NO:	HSE-EAP-012	PAGE:	2 OF 4
DOCUMENT NAME: RESCUE RESPONSE PLAN			

- All Rescue personnel shall wear a minimum of a Class III harness, helmet, gloves, and safety glasses during rescue activities; operating within confined spaces or outside guardrails.
- All Primary and Secondary Rescuers shall employ safety lines at all times except where they pose a greater risk to the safety of the rescuer. All safety lines shall be equipped with “shock absorbing” devices.
- Access and egress systems shall provide for the immediate retrieval of all rescuers.
- All rescue systems shall be “rigged” for two person loading.
- Preliminary atmospheric testing shall be conducted prior to entering any confined space.
- Where permitted, entries into atmospheres containing less than 19.5% oxygen shall require the use of self-contained breathing apparatus used in accordance with the manufacturer’s recommendations.
- Where permitted, entries into atmospheres containing 10% or less of the Lower Explosive Level (LEL) shall only be made where the source of flammability can be identified and controlled. Where atmospheres contain greater than 10% of the LEL, engineering controls shall be employed to lower the percentage to less than 10% prior to entry.
- Where permitted, entries into atmospheres containing toxic levels of hazardous materials shall only be made when a Material Safety Data Sheet (MSDS) identifies the material and recommended personal protective equipment is available to protect all personnel.
- In cases where engineering controls are used to eliminate or control hazards, their effectiveness and continued operation shall be monitored frequently.
- Where the atmosphere within a confined space cannot be thoroughly tested from the point of access, positive pressure breathing apparatus shall be worn and the atmosphere within the space shall be checked by the use of a personal monitor affixed to the primary rescuer. If the results of the monitoring indicate an acceptable atmosphere, rescuers may remove their face piece.
- Whenever rescuers wear respiratory protective devices, additional apparatus shall be provided for the patient(s).
- When respiratory protection is worn, the “On Air” time shall be recorded.
- When used, SCBAs must be capable of passing through openings when worn in their “design” position.

DOCUMENT NO:	HSE-EAP-012	PAGE:	3 OF 4
DOCUMENT NAME: RESCUE RESPONSE PLAN			

- Where combination Supplied Air SCBAs are used, it shall be in a manner consistent with their NIOSH Approval.
- Engineering controls, such as ventilation, shall be employed whenever practical to control ambient conditions.
- All potential exposure information shall be documented and appropriate personal protective equipment shall be worn.
- An effective form of communication with the rescuers shall be established prior to entering any confined space. In all cases where rescuers are required to work without "line of sight" contact, a primary and secondary means of communication shall be established.
- All patients shall be handled and packaged in a manner consistent with their medical needs, except where continued exposure to environmental conditions may cause further injury or death. All patients shall be treated according to **Approved Medical Protocols**
- Where hazardous materials may contaminate patients, they shall be handled in a manner consistent with their medical condition. Patient contamination information shall be given to the Medical Treatment and Transportation Personnel.

DOCUMENT NO:	HSE-EAP-012	PAGE:	4 OF 4
DOCUMENT NAME:			
RESCUE RESPONSE PLAN			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

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2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-017	Page: 1 OF 6	Approval Date:	06/30/2011
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Radiation sources are located in several permanent and fixed areas of the refinery. Permanent sources are located on various process vessels and equipment for level (gauging) and flow indication. Other portable sources are brought into the refinery to perform radiography inspections to piping and equipment (non-destructive testing / X-ray).

Radiation sources are maintained in shielded enclosures which direct and control radiation release for useful purposes. Under normal circumstances, sources located in their shielded housings present no hazard. However, if the shielding is breached, the potential for radiation exposure exists. Shielded enclosures for radiation sources are substantial and under any circumstances their failure is remote. This section provides procedures and guidelines to use if source controls have been breached.

For a list of permanent sources in the refinery, see [Appendix 1: Locations of Radiation Sources in the Refinery](#).

MANAGEMENT OF RADIATION EMERGENCIES

An emergency where a source is exposed requires the same reporting and will receive the same response as any other emergency. The Incident Command System (ICS) will be used for management of all radiation scene emergencies. Responses shall be according to the response classifications (Alert Levels) for the respective type of emergency. However, due to the nature and strength of permanent or portable sources, Response Classifications beyond an Alert 2 are not necessary.

Types of Radiation Emergencies

A radiation hazard will exist if the radiation from a source is not controlled by shielding. Events which could breach the shielding and propagate a radiation emergency may include, but not be limited to the following types of events:

- Fires and explosions involving radioactive sources (e.g., fires or explosions which expose source instrumentation to excessive heat or mechanical damage from an explosion).
- Radiography equipment malfunction (e.g., disconnected sources from radiography cameras).
- Mechanical damage to source housing (e.g., damage to source instrument housings by other mechanical equipment or other failures).
- Vehicular accidents involving the movement of sources (e.g., radiography or other transport trucks).

DOCUMENT NO:	HSE-EAP-012	PAGE:	2 OF 7
DOCUMENT NAME: RADIATION RESPONSE PLAN			

Identification of Materials Involved

As with all hazardous materials emergencies, the identification of the materials involved is of primary concern in order to properly:

- Provide strategic planning.
- Assess the risks so that effective tactical actions can be taken.
- Protect responders.
- Protect the community.

The Incident Commander and Tactical Officers must quickly determine if radioactive sources are involved in any emergency to provide the proper planning and protection.

Fires and Explosions Involving Radioactive Sources

Exposure risk must be considered on any lines or vessels that are involved in fires or explosions upon which radioactive sources are used for gauging and flow indication.

An explosion may cause a source to be misplaced from its protective housing. Although refinery sources are classified as “low level”, they must be considered hazardous and treated accordingly.

Damage to source-containing instrumentation by fire exposure is considered remote due to the substantial protective housings. However, if the instruments have been exposed to fire, ER - Command must consider that damage may have occurred and take appropriate steps to protect Emergency Response members providing fire control support. Proper verification must be made that radiation leakage is not occurring.

Radiography Equipment Malfunction

Radiography is a process of testing materials using penetrating radiation such as X-rays or gamma rays. This allows examination of the interior of objects or assemblies that are impenetrable to light. Sources used for radiography are considered “high level” and pose a potential risk to personnel.

The malfunction of radiography equipment can leave a source unprotected and exposed. Two basic types of malfunctions may occur:

- The camera device malfunctions leaving the source extended (exposed) with the inability to retrieve (secure) it properly.
- A camera malfunctions allowing the source to be extended and disconnected from the device leaving no means of retrieval.

Either event will leave the source exposed and unshielded providing potentially high exposures to personnel.

DOCUMENT NO:	HSE-EAP-012	PAGE:	3 OF 7
DOCUMENT NAME: RADIATION RESPONSE PLAN			

Mechanical Damage to Source Housing

The housing for all radioactive sources is substantial. A powerful mechanism would have to be employed to mechanically damage gauging instrumentation or radiography equipment shielding. However, if a mechanical stress has been employed on the housing, careful consideration and steps must be taken until it can be verified that the shielding is intact and no leakage is occurring.

Vehicle Accidents Involving the Movement of Sources

Radioactive sources are commonly moved in the refinery by truck. Stringent packaging and securing must be performed before a source can be transported. Radiography sources are the most common source moved by vehicle.

In transit, vehicles carrying sources may be involved in traffic accidents or fires. Potential damage to the source housings are similar to those previously described for fires, explosions and mechanical damage.

If properly packaged and secured, it is unlikely that a breach of the housing could occur. However any vehicle accident must be treated as if the housing has been damaged until verification can be made that no leakage is occurring.

Procedures for Handling Radiation Emergencies

For radiation emergencies, the Plant Emergency Notification system will be activated, and standard procedures and response orders will be followed. A minimum of a Non essential Personnel Evacuation of the area will be issued.

Generally, three items must be considered for protection from radiation:

- Distance
- Shielding
- Time (time exposed).

The following are specific procedures for handling radiation emergencies in the facility:

- For all unknown source exposures, the area within a radius (in all directions) of 150 feet must be immediately evacuated and secured (isolated).
- The Refinery Radiation Safety Officer (RSO) must be immediately notified.
- The Industrial Hygienist On-Call shall become the Industrial Hygiene Officer until relieved by the RSO.
- The secured area shall be monitored to ensure the hot zone is established properly. The area shall be barricaded at the 2 mr/hr mark. (Areas outside the hot zone shall be at 2 mr/hr or less.)

DOCUMENT NO:	HSE-EAP-012	PAGE:	4 OF 7
DOCUMENT NAME: RADIATION RESPONSE PLAN			

Tactical Divisions will coordinate with the Incident Commander, the Operations Section Chief and the Security Coordinator to establish and monitor site control zones.

The concept of a Control Zone is illustrated in the [Hazardous Materials Response Plan, Appendix 2: Control Zones](#).

For information concerning in plant and outside roadblocks, see [HSE-EAP-004 Emergency Site Security and Control](#)

- The RSO will notify directly or ensure notification of the following:
 - ⇒ Texas Department of Health Bureau of Radiation Control
 - ⇒ A Contractor licensed by the Bureau of Radiation Control
- Only a licensed radiation contractor is qualified and trained to perform emergency recovery and securing of exposed sources. **No Houston Refinery Emergency Response personnel will perform recovery and securing operations.**

Naturally Occurring Radioactive Material, NORM

Naturally Occurring Radioactive Materials (NORM) are located in rock and soil formations throughout the earth's crust. NORM is found in many oil and gas streams and may move with these streams as they are extracted and transported. NORM may be found on vessel walls, piping, pump casings and other process equipment.

Emergencies and incidents involving NORM may include accidents involving NORM-contaminated equipment or waste. NORM-contaminated equipment and waste is considered to be a "low level" hazard and normally poses only minimal health risks by skin exposure or inhalation. Handling of these types of events will be in accordance with the **HSE FIELD MANUAL, Procedure 14: Naturally Occurring Radioactive Material (NORM)**.

DOCUMENT NO:	HSE-EAP-012	PAGE:	5 OF 7
DOCUMENT NAME:			
RADIATION RESPONSE PLAN			



**APPENDIX 1:
LOCATIONS OF RADIATION SOURCES IN THE REFINERY
ISOTOPES, STRENGTH OF SOURCES AND ROPE OFF DISTANCES**

Unit	Isotope	Location of Source	Activity	Radiation Type	Total Sources	Rope Off Distance During Emergencies
736 Coker	Cs ¹³⁷	Coker Drums	2400 mCi	Gamma	2 each drum	65'
	Cs ¹³⁷	2 nd deck pipe rack, feed to heater	100 mCi	Gamma	1	20'
	Cs ¹³⁷	Fractionator Feed Line	200 mCi	Gamma	2	25'
737 Coker	Cs ¹³⁷	Coker Drums	2000 mCi	Gamma	6 each drum	60'
	Cs ¹³⁷	Frac tower	1000 mCi	Gamma	1	50'
	Cs ¹³⁷	Vacuum resid line	1000 mCi	Gamma	1	50'
Fluid Unit	Cs ¹³⁷	Clarified Oil Line CBO	50 mCi	Gamma	1	15'
Fluid unit	Cs ¹³⁷	T1 Fractionator Tower	2400 mCi	Gamma	1	65'
OP Feed Line	Cs ¹³⁷	Pipeline on Illinois St., North of Admin Building	100 mCi	Gamma	1	20'
Pipeline	Cs ¹³⁷	LSVGO 2 PRSI	40 mCi	Gamma	1	10'
ARU	Cs ¹³⁷	UDEX Reflux Tower	100 mCi	Gamma	1	20'
ARU	Cs ¹³⁷	UDEX Raffinate Wash Tower	200 mCi	Gamma	1	25'
ARU	Cs ¹³⁷	UDEX Extract Wash Tower	200 mCi	Gamma	1	25'
536 Crude Still	Cs ¹³⁷	16" Crude feed pipe	100 mCi	Gamma	1	20'

DOCUMENT NO:	HSE-EAP-012	PAGE:	6 OF 7
DOCUMENT NAME:			
RADIATION RESPONSE PLAN			

Unit	Isotope	Location of Source	Activity	Radiation Type	Total Sources	Rope Off Distance During Emergencies
536 Vac Tower	Cs ¹³⁷	Level meter	2000 mCi	Gamma	1	60'
537 Vacuum Tower	Cs ¹³⁷	Level meter	2000 mCi	Gamma	1	60'
537 Crude	Cs ¹³⁷	T-1 Tower	1000 mCi	Gamma	1	40'
BTU	Cs ¹³⁷	Extract Stripper Reflux feed line	20 mCi	Gamma	1	10'
Inspection Lab	Cd109 Fe 55	Inside the lab	10 mCi 20 mCi	X-Ray		
Warehouse	Am241 Fe55	Main office area at warehouse	30 mCi 20 mCi	X-Ray		

DOCUMENT NO:	HSE-EAP-012	PAGE:	7 OF 7
DOCUMENT NAME:			
RADIATION RESPONSE PLAN			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
1/18/2011	Sheryl Kuhfeldt	Reformat, reorganize and regulatory review of procedure	
05/20/2011	Jeff Windham	Revised list of radiation sources	CM

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TABLE OF CONTENTS

Summary	2
Roles and Responsibilities	2
Procedure	5
Hurricane Preparedness Plan	5
High Winds, Severe Thunderstorms and Tornadoes	16
Flooding	16
Freeze Preparedness Plan	17
Lightning Threats	18
Appendix 1-Severe Weather Management Team Roles and Responsibilities	21
Appendix 2-Storm Terminology	36
Appendix 3-Hurricane Preparedness Phase 1 Preseason Checklist	38
Appendix 4-Hurricane Preparedness Phase 2 Checklist	41
Appendix 5-Hurricane Preparedness Phase 3 Checklist	45
Appendix 6-Planning and Personnel Staffing Plan	47
Appendix 7-Hurricane Preparedness Timeline	47
Appendix 8-Operations Circulation/Shutdown Timing	47
Appendix 9-Circulation Shut-Down Guideline	48
Appendix 10-Employee Emergency Tracking Form	47
Revision Summary	55

DOCUMENT NO:	HSE-EAP-015	PAGE:	2 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

SUMMARY

SEVERE WEATHER MANAGEMENT PLAN

This plan provides a coordinated, teamwork-based program intended to reduce the potential for injury to personnel, damage to facilities or curtailment of production due to severe weather.

For purposes of this plan, "severe weather" shall be defined as hurricanes, sub-freezing temperatures, severe thunderstorms or flooding (from other than hurricane related rainfall or tides).

ROLES & RESPONSIBILITIES

SEVERE WEATHER MANAGEMENT TEAM

The Severe Weather Management Team is composed of senior management team leader and various functional teams, which guide implementation of the severe weather management plan.

Emergency Management personnel have responsibility for monitoring weather forecasts and informing management of weather conditions that have a possibility of adversely impacting the refinery. Main Gate Security has front-line responsibility for monitoring weather conditions that could imminently affect refinery operations and notifying the Plant Shift Superintendent (PSS) when a weather threat is identified. The PSS has responsibility for coordinating preparedness activities when there is an imminent threat of severe weather. In the event of a severe weather impact, the PSS will advise the Executive On Call regarding refinery status.

In the event of severe weather, the Severe Weather Management Team Leader may activate the plan. The Team Leader shall be responsible for implementing the applicable parts of this plan as needed to deal with threatening severe weather conditions.

The team shall serve as the refinery's advisory and resource group for all phases of the severe weather management plan. As conditions dictate, the team will make recommendations for securing plant equipment and protecting personnel following prescribed checklists and schedules.

Headquarters of the Severe Weather Management Team will be in the Emergency Operations Center (EOC).

The Severe Weather Management Team Organization and Roles & Responsibilities can be referenced in

[Appendix 1: Severe Weather Management Team Roles & Responsibilities](#)

DOCUMENT NO:	HSE-EAP-015	PAGE:	3 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

METEOROLOGY SERVICES and WEATHER INFORMATION

Refinery site specific meteorological services are provided by ImpactWeather, Inc. All information is available by logging on to the ImpactWeather member Internet site. Services provided include:

- ❑ Daily Planning Forecast – issued early each morning, provides expected weather conditions throughout the following week. Daily Planning Forecasts are also faxed to the Plant Shift Superintendent, Main Gate Security, HSE, and the Main Lobby.
- ❑ Severe Weather Threat Assessments – updated several times a day, provides indication of severe weather that may affect the refinery during the current and next day. Severe Weather Threat Assessments are available on the ImpactWeather member Internet site. Notification of the potential for severe weather events such as tornado outbreaks or ice storms is also emailed to select personnel.
- ❑ Severe Weather Alerts – phased alerting system that provides notification that severe weather may, or will affect the refinery within the next several hours. The color-coded condition alert system is:
 - Green – All Clear. No severe weather currently predicted.
 - Yellow – Severe weather is possible within the next several hours. A Condition Yellow Alert is issued when the threat is judged to be both severe, and likely to occur
 - Orange – Issued when significant weather is likely to occur within the next hour. Condition Orange Alerts will typically be issued for thunderstorm type of activity and indicate the strong possibility of conditions including but not limited to wind gusts over 45 mph, the possibility of tornadoes, very frequent lightning, and hail
 - Red – Extremely severe weather is imminent within the hour. Condition Red Alerts are reserved only for the most hazardous weather events. Conditions that may call for a Condition Red include but are not limited to verified tornado activity hail over 2 inches in diameter and wind gusts over 60 mph.

The refinery receives Severe Weather Alerts via Fax at the PSS Office, Main Gate Security, HSE, and the Main Lobby as well as specific personnel email and pager notifications. Red Severe Weather Alerts also result in a phone call to Main Gate Security.

- ❑ Tropical Weather Service – provides information on tropical weather development throughout hurricane season, and outlooks on specific tropical events that have a possibility of affecting the refinery. The tropical weather service includes site specific conditions that can reasonably be expected over the forecast time period.

DOCUMENT NO:	HSE-EAP-015	PAGE:	4 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

- Meteorologist Consultation – ImpactWeather’s duty meteorologist is also available 24 hours a day for live consultation or clarification of information by calling the toll free ImpactWeather line.

The refinery has two local on-site weather stations. These stations are located on top of the Administration Building and the C&P Building, and are used to provide real time wind speed, wind direction, and temperature information. Data from the stations is available at Main Gate Security, and in the HSE Workroom.

Additionally, local weather information in close proximity to the refinery is available at the following Internet sites

- TxDOT Roadway Weather Sensors: <http://pri.hcoem.org/txdot/> (closest sensor is 610 Bridge over the Houston Ship Channel)
- Houston Hobby Airport:
<http://weather.noaa.gov/weather/current/KHOU.html>

EMPLOYEE COMMUNICATIONS

When severe weather threatens, or has affected the refinery, Houston Refining employees may obtain information on the refinery’s status and return-to-work requirements by:

- Accessing www.hrohme.com on the Internet
- Calling the **Lyondellbasell Info Line** toll-free, **1-888-457-6118** (select 2 - East Region, then 6 - Houston Refinery)
- Calling the **HRO Employee Emergency and Severe Weather Information Line at 713-321-5775**

If necessary, the refinery will utilize print, television, and radio media to disseminate information to employees as well:

- **NewsRadio 740 KTRH**, located on the AM frequency is the primary outlet

DOCUMENT NO:	HSE-EAP-015	PAGE:	5 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

PROCEDURE

HURRICANE PREPAREDNESS PLAN

Hurricanes are the most threatening of all severe weather conditions, and therefore are the principal focus of this plan. The advance warning available for hurricanes typically provides sufficient time for preparation and protection of facilities, equipment, and personnel.

This Hurricane Preparedness Plan features procedures and guidelines for use prior to, during, and immediately after a storm to help ensure that plant equipment is properly secured, personnel are not exposed to preventable hazards, and disruption of operations is minimized. Commonly used Tropical Weather terminology associated with this plan is provided in [Appendix 2: Storm Terminology](#)

Included in this plan are checklists, schedules and timelines for use as guides to coordinate an orderly preparation and shutdown of the facility in the event the Severe Weather Management Team Leader calls for such action. Stated preparation and shutdown guidelines may be adjusted with the approval of the team leader based on existing and expected weather conditions and probability data.

Activation of this plan shall be considered if the Houston area is within the 75% landfall probability cone, or it is reasonably possible that the Houston area could be impacted by a tropical storm / hurricane.

Unless specifically noted otherwise, the estimated time of arrival of sustained 40 mph winds is the "reference" point for all decisions and activity timing in this hurricane preparedness plan.

Severe Weather Checklists

The Hurricane Preparedness Plan provides for preventive / asset protection activities in three phases.

Each refinery department that is responsible for specific storm preparation activity should develop and maintain department specific storm phase checklists.

Phase 1: Preseason Checklist

Phase 1 is defined as the period from the start of hurricane season until an actual storm is close enough to be a threat. Phase 1 activities are to be completed prior to the start of hurricane season.

The Phase 1 Checklist is located in [Appendix 3: Hurricane Preparedness Phase 1 Pre-Season Checklist](#). The Phase 1 Checklist includes sandbagging charts for flood prevention of critical equipment.

DOCUMENT NO:	HSE-EAP-015	PAGE:	6 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Phase 2: Checklist

In anticipation of a hurricane, Phase 2 activities shall begin at the direction of the Severe Weather Management Team Leader.

The decision to implement Phase 2 will be a judgment decision based on the best available weather information at the time. Initiation of Phase 2 preparations should be considered prior to 96 hours in advance of the arrival of sustained 40 mph winds.

Some of the items in this checklist are duplications of Phase 1. However, all of these items must be checked again immediately before the arrival of severe weather and any necessary corrective action taken without delay.

The Phase 2 Checklist is located in [Appendix 4: Hurricane Preparedness Phase 2 Checklist](#).

Phase 3: Checklist

In anticipation of a hurricane, Phase 3 final preparations, including appropriate operations curtailments shall begin at the direction of the Severe Weather Management Team Leader at approximately 72 hours in advance of sustained tropical storm force winds (40 mph).

The beginning of Phase 3 activity is based on the best available weather information.

Non-essential personnel may be released at the discretion of management.

When Phase 3 is initiated, all of the Phase 3 checklist items shall be expedited.

The Phase 3 Checklist is located in [Appendix 5: Hurricane Preparedness Phase 3 Checklist](#).

Hurricane Teams and Associated Staffing

As part of the Phase 1 activity, each manager / superintendent is responsible for obtaining an adequate number of appropriately skilled personnel to serve on the Shutdown / Startup Team and Rideout Team. Personnel who could fill positions in the recovery organization should be identified and their emergency / 3rd party contact information should be obtained during Phase 1. Where specialty contractor personnel are required, the departmental contact is responsible for working with Purchasing to ensure that an appropriate number of skilled contractors will be available.

For information on the various storm teams' staffing needs, see [Appendix 6: Hurricane Planning, Personnel Staffing Plans](#).

DOCUMENT NO:	HSE-EAP-015	PAGE:	7 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Upon initiation of the Phase 2 activity, four hurricane teams will be established. The teams are:

- Shutdown / Startup Team (SST) – The SST will assume operations responsibility from the normal operations staff and has responsibility to operate the refinery at reduced or circulation rates, and/or shutdown the plant per direction of the Severe Weather Management Team. Should storm conditions be less than expected, the SST may begin startup preparation activity to a point allowed by the number of personnel available. If the refinery is shut down, and based on the expectation for certain storm conditions, the SST may be moved as a group to a safe location away from the refinery. The SST is primarily composed of operations personnel, with appropriate support staff.
- Rideout Team (RT) – The RT is defined as the group of personnel that will attend to and manage the refinery in the event of a total shutdown and evacuation of the SST. The RT's primary responsibility in this case is fire watch, security of the plant, and initiating preliminary hazard / damage assessments after a storm has passed. The RT mainly consists of personnel who rollover from the SST and is composed of Operations, Reliability, IS, HSE, and ERT personnel.
- Assessment Team (AT) – The AT is formed from Rideout Team members and is responsible for performing plant-wide and unit perimeter assessments for acute hazards and significant damage with intent to identify those hazards, mitigate them where practical, and clear the operating units for entry of Recovery Team personnel to perform detailed assessments and repairs. AT personnel may be moved to a safe location with the SST in the event conditions dictate that action. The AT will be coordinated into an appropriate number of individual teams that will typically consist of HSE, Reliability, and Operations personnel.
- Recovery Team – The Recovery Team is responsible for managing repair activity that is necessary to put the refinery in a condition to allow safe startup. The Recovery Team will relieve the Rideout and Assessment Teams. Transition to the Recovery Team effort will typically take place at some point after the Assessment Teams have completed and documented the initial assessments and cleared the units for detailed assessments entry. The Recovery Team will be activated by and report to the refinery at a time determined appropriate by the Severe Weather Management Team. For more information on the recovery effort, see the HRO Hurricane Recovery Plan (need to know where this will be kept).

Note: Some personnel, with cross-functional skills and knowledge may be assigned to serve on multiple teams with primary responsibility dependant on the team that is primarily active at a certain time.

DOCUMENT NO:	HSE-EAP-015	PAGE:	8 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Each manager / superintendent will validate / update their storm teams' personnel lists during Phase 2. The Emergency Management Coordinator or designee shall be notified of any changes that are necessary. Managers / Superintendents will retain the list of storm team personnel from their area, and fax a copy to EOC at 713-609-6245.

Hurricane Preparedness Timeline

The Hurricane Preparedness Timeline is designed to facilitate planning for facility preparation, release and reporting of personnel and operations curtailment activities. Although the various activities in the timeline are defined, actual activity and initiation points may vary with specific storm data.

The general and an interactive preparedness timeline are located in [Appendix 7: Hurricane Preparedness Timeline](#).

Release and Reporting of Personnel

Proper timing in the release and reporting of various personnel groups is essential to help ensure employee safety and adequate facility preparation. The following times should be used as a guide to release and reporting. Times indicated are in advance of the predicted arrival of 40 mph sustained winds.

96 Hours:	<ul style="list-style-type: none"> Release Shutdown / Startup Team for home and family preparation
72 Hours:	<ul style="list-style-type: none"> Begin the staggered release of non-essential personnel Release Rideout Team and Assessment Team for home and family preparation
60 Hours:	<ul style="list-style-type: none"> Shutdown / Startup Team report for storm duty
48 Hours:	<ul style="list-style-type: none"> Release of non-essential personnel outside of Operations complete Begin release of operations personnel who are not on SST / RT as unit operational status allows
36 Hours:	<ul style="list-style-type: none"> Rideout Team and Assessment Team report for storm duty Release of operations personnel who are not on SST / RT complete
12 Hours:	<ul style="list-style-type: none"> Release of Shutdown Team complete
0 – 12 Hours	<ul style="list-style-type: none"> Final preparations

Note: Release and reporting of personnel assigned to both the Shutdown / Startup Team and the Rideout Team should align with that of the Shutdown / Startup Team.

Operations Curtailments / Decision Points

Various levels of operations curtailment will be considered if the refinery is within the 75% probability window of receiving sustained tropical storm force winds (40 mph) for extended periods.

DOCUMENT NO:	HSE-EAP-015	PAGE:	9 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Operational decisions will be based on predicted conditions at the refinery and length of exposure. The following guidelines will be used to outline the operational decision-making process:

- ❑ Sustained winds up to 40 mph: Normal Operating Conditions
- ❑ Sustained winds over 40 mph for up to 4 hours: Rate Reductions
- ❑ Sustained winds over 40 mph for more than 4 hours: Refinery on Circulation
- ❑ Sustained winds over 75 mph for more than 2 hours: Plant Shut Down

Depending on the intensity and track of the storm, and other applicable issues, the following timing points are critical in considering possible operations curtailments:

- ❑ Initiation to 72 Hours: Begin discussions and decision making process
- ❑ 60 Hours: Critical decision point for going to minimum refinery rates
- ❑ 48 Hours: Critical decision point for taking the refinery to total circulation
- ❑ 36 Hours: Critical decision point for continuing with circulation or initiating shutdown

All units should be at operating conditions determined to be appropriate for the expected weather conditions 12 hours prior to the arrival of 40 mph sustained winds. Guidelines for circulation and shutdown timing of all units can be found in [Appendix 8: Operations Circulation / Shutdown Timing](#).

[The Total Refinery Circulation / Shutdown Guideline is shown in Appendix 9.](#)

Incident Management

EOC shall be established at a minimum level 36 hours prior to the arrival of sustained 40 mph winds to facilitate situation development tracking and accountability of storm team personnel.

Command shall be established approximately four hours prior to the arrival of sustained 40 mph winds.

Calpine Operability and Relocation

Calpine Cogeneration plans to maintain utilities production at a level commensurate with the refinery's demand needs throughout the storm event or as long as possible. However, wind speed conditions may limit Calpine's ability to safely occupy its control building. Calpine management will determine the conditions upon which an evacuation of their facility will be necessary. Generally, Calpine personnel will shelter within the Calpine facility during storms with wind expectations up to 95 mph sustained winds. If conditions dictate evacuation of the Calpine facility, Calpine personnel will be relocated to the HRO CCRB. From there, Calpine personnel will be able to operate their processes. Relocation will be facilitated by HRO Emergency Services.

DOCUMENT NO:	HSE-EAP-015	PAGE:	10 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

To facilitate the evacuation decision making process, a detailed condition expectations forecast will be provided to Calpine when sustained wind speeds greater than 40 mph are predicted.

Communication with Calpine will be the responsibility of the PSS and the Utilities Board Operator. Communication links will be via telephone or Utilities Channel 1.

If an evacuation determination is made, the following process will be followed:

- ❑ Two hours prior to the expectation for 40 mph sustained winds, Command will designate personnel to proceed to the Calpine Control Building to transport the initial personnel group to the CCRB.
- ❑ The initial group of Calpine employees will ensure that the interface from the CCRB is operating and will then take over control of the Calpine processes.
- ❑ The remaining personnel will then be picked up and delivered to the CCRB.

Personnel Safety, Tracking & Accountability

Personnel On-Site

As conditions deteriorate limitations on outside activity and accountability of all personnel within the refinery becomes paramount.

This Accountability Plan is applicable to all HRO, Contract, and Calpine personnel working at the refinery site during tropical storm and/or hurricane weather events. This plan can be utilized to account for personnel during other adverse events as well.

On-Site Accountability processes shall be initiated by Command prior to the arrival of 40 mph winds. Accountability will be documented and maintained in effect until the Severe Weather Management Team Leader, Command, and the Plant Shift Superintendent determine it is no longer necessary. It is particularly critical that accountability of damage assessment teams be conducted throughout the assessment process.

Upon initiation of this Accountability Process:

- ❑ A Facility Accountability Coordinator (FAC) shall be appointed to track the location and working status of each person at the refinery. The FAC will work from EOC.
- ❑ Each department / area will fax a personnel list to EOC (ext. 6245) indicating those people who are currently on-site and assigned to that area. Any changes as a result of people arriving, departing, or moving to a different area shall be communicated to EOC.

DOCUMENT NO:	HSE-EAP-015	PAGE:	11 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

- ❑ EOC will validate the on-site personnel list against a report generated by the Security Access Control System to verify that all personnel on-site are accounted for.
- ❑ Outside activity shall be minimized to the extent possible at sustained wind speeds of 25 mph or greater.
- ❑ At sustained wind speeds of 40 mph or greater, outside activity must be approved by Command (in EOC @ ext. 4844) and by the Plant Shift Superintendent. EOC will be notified of personnel who will be working outside, and then notified when outside activity is complete and personnel have returned to their assigned area.
- ❑ As the storm passes and winds begin to subside, restrictions on outside activity as indicated above will be maintained until discontinued by the Severe Weather Management Team Leader and Command.

Personnel Off-Site

All employees will update their contact information in iManage prior to Hurricane Season and immediately prior to specific storm events.

Prior to each storm that is expected to impact the greater Houston area; supervisors / managers are responsible for obtaining storm contact / evacuation information from their direct reports and critical contract personnel.

[Appendix 10: Houston Refining Employee Emergency Tracking Forms](#) will be utilized for this purpose. Hard copies are to be retained by the supervisor/manager and by a designee/backup throughout the adverse condition, with a copy emailed to HRO EOC, or faxed to EOC at 713-609-6245.

After storm events have impacted the area:

- ❑ Employees will be responsible for keeping track of refinery conditions and return-to-work requirements via the methods mentioned in the **Employee Communications** section above.
- ❑ Employees are required to check in within 24 hours of the storm event via the www.hrohome.com website, or the **Lyondell Basell Info Line (1-888-457-6118)** as listed in the **Employee Communications** section above and provide info on their location, how they can be reached, their availability to return to work and any significant personal losses or need for assistance.

DOCUMENT NO:	HSE-EAP-015	PAGE:	12 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

- As an alternate means to check in, employees may email or send a text message to hrocheckin@lyondellbasell.com with the above information.

NOTE: Contact numbers for the Plant Shift Superintendent and Shift Clerks SHOULD NOT be used for employee check-in or general information about plant conditions. These lines should be restricted to official ongoing, real-time plant operations.

Post-Storm Assessment Process

If a severe weather system has affected the refinery, post-storm impact assessments will be conducted prior to personnel entering areas to perform work. The intent is to identify, assess, and mitigate hazards that may have been created by storm conditions.

This section will be utilized as a guide to perform post-storm assessments in order to ensure the highest level of personnel safety. Assessments will be conducted under the Incident Command System. This section also provides guidance on possible action to be taken to mitigate those hazards in order to create a safe work environment.

Potential Hazards

The following represent some, but not all hazards that present the potential for unquantified exposures in the timeframe immediately after a severe weather event:

- Electrical Hazards
- Flooding
- Currents (receding water)
- Loose hydrocarbons
- Chemical exposures
- Asbestos
- Undermining of soil
- Structural failure
- Obscuration of walking surfaces via flood water
- Missing grates and hole coverings
- Slip, Trip, Fall Hazards
- Unexpected energization of equipment
- Sharp edges
- Wildlife (snakes)

Note: If flooding has occurred, assessments in flooded areas may begin after flood water has receded to a point that the area perimeter can be safely traversed by vehicle or by foot as appropriate. Personnel should avoid walking into areas that are flooded. However, if it becomes imperative to access flooded areas, the task should be discussed with supervision and personnel must take extra precautions to avoid trips and falls. These precautions may include, but are not limited to developing pre-task safety plan, assessing the electrical hazards within the flooded area, appropriate PPE, an observer that stays in a safe location, the use of a pole to probe the area before taking steps, and if possible, a retrieval line.

Additionally, decontamination stations shall be established if personnel must enter flooded / contaminated areas.

DOCUMENT NO:	HSE-EAP-015	PAGE:	13 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Assessment Teams

In order to assess these hazards, teams of appropriately knowledgeable personnel will perform staged surveys to identify, and if possible, manage identified hazards. Survey teams will consist of:

- HSE
- Electrical
- Engineering (Structural, Civil, Mechanical, Process)
- Process Control
- Operations
- Others as identified

Hazard Abatement and Identification

If the refinery experiences a TOTAL power loss during a period of severe weather, the first step in providing a safe work environment is to isolate the refinery power distribution system by opening the two main 69kV breakers and the two main 15kV breakers located at the 138kV Substation. Once power is restored by either the Cogeneration Facility or the Utility, the refinery Power Distribution Group will bring units back on-line in an orderly fashion, but only after a thorough inspection of each unit has occurred to eliminate the potential for damaged circuits to become energized when power is restored.

Otherwise, the system is designed to react to faults which may occur as a result of severe weather damage. The refinery power grid will remain on during the event, and specific breakers / switches will be opened to isolate damaged circuits only once the storm has passed.

Process computers shall be put into a state that prevents them from trying to control the process until such times as all process equipment has been assessed and declared useable.

Identified damage and hazards shall be documented on the provided plot plans with the plot plans being returned to EOC after the assessment is complete. Damage shall also be documented via camera. Unmitigated hazards shall be identified by visual means (paint, barricade tape, etc.).

Assessment Process

Each Assessment Team will be provided gridded plot plans which shall be utilized to identify the boundaries of each team's responsibility, the areas where various assessments have been completed, and to indicate hazards found within those areas. A Site Safety Plan shall be established by the Safety Officer and reviewed with all Assessment Teams. Assessment Teams shall be deployed and operated under the established Incident Command System. A Division Supervisor or Team Leader respectively, shall report the team's position, progress, and accountability as required.

DOCUMENT NO:	HSE-EAP-015	PAGE:	14 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Initial perimeter / boundary assessments of process and tank farm areas are intended to determine to the extent possible, if chemical, asbestos, fire, structural, and electrical exposure hazards are present. These surveys should be conducted visually and with four gas detection meters (LEL, O2, H2S, and HC). Personnel performing these assessments may utilize vehicles and shall have bunker gear and SCBA available. These assessments will be performed by HSE / ERT, Operations, and Reliability personnel. Initial surveys will assist in the determination of appropriate personal protective equipment for detailed assessments.

After perimeter surveys are complete, similar but more detailed assessments (visual and with four gas meters) will occur within process and tank farm areas to further identify the potential for chemical, asbestos, fire, and electrical exposure hazards. These assessments will be performed by HSE / ERT, Operations, and Reliability personnel.

After areas have been declared clear of chemical exposure, fire, and electrical hazards, or after identified hazards have been mitigated, structural integrity surveys shall be completed to identify possible structural failure hazards. The structural surveys are intended to identify as much as possible, structures and structural members that have already failed, or have been stressed to the point that they may fail as recovery operations continue. Since cooling towers are very susceptible to wind damage, particular attention should be placed on examination of cooling tower stairs and load bearing members. Special attention should also be given to the potential of structural / support compromise caused by receding water undermining foundation soil. Personnel performing these assessments will typically consist of Reliability Engineering, Operations, Maintenance, and HSE personnel.

After areas have been declared clear of structural failure hazards, or after identified hazards have been visually identified and barricaded, and/or mitigated, operations equipment assessments shall be conducted. These assessments are intended to examine all process pumps, valves, check valves, motors, compressors, heaters, process control equipment, etc to identify damage or process integrity issues that may have occurred. Personnel performing these assessments will typically consist of Operations, Ref Tech, Reliability, and Maintenance personnel.

After the operations equipment surveys have been completed and process equipment integrity problems have been appropriately mitigated, those areas will be declared free of storm hazards and the areas will be turned over to the owning areas for an appropriate level of pre-startup safety review.

DOCUMENT NO:	HSE-EAP-015	PAGE:	15 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

HIGH WINDS, SEVERE THUNDERSTORMS, LIGHTNING AND TORNAOES

This category of severe weather usually occurs on short notice such that organized preparation is not usually possible. However, to the extent that preparation is possible, the applicable checklist items in [Appendix 3: Hurricane Preparedness Phase 1 Pre-Season Checklist](#) ensure an annual review of items related to high winds and severe thunderstorms.

If sustained high winds are predicted, then as a minimum, a general cleanup of the facility should be ordered with special attention given to removing or securing loose items, trash, construction materials and small equipment which could be damaged or become airborne. Winds above 40 mph will make dangerous missiles out of otherwise harmless materials, such as boards, buckets, cans, bottles and even small stones. Loose sheet metal in a high wind is especially dangerous to personnel and to electrical equipment. Flying sheet metal coming in contact with power lines or substation equipment can easily cause a power outage with serious consequences to plant operations.

FLOODING

Flooding from non-hurricane related causes usually happens with little advance warning. In the event such flooding is predicted, the applicable parts of the [Appendix 3: Hurricane Preparedness Phase 1 Pre-season Checklist](#) should be used as a guide in flood preparation actions. Since advance warning may be limited to only a few hours, each individual with severe weather responsibilities should quickly prioritize the actions to be taken (assuming ample time to be available) and ensure that the most critical of those actions are carried out first.

If a plant curtailment or shutdown is ordered and sufficient time is available before arrival of the flood, the "Schedule for Unit Shutdown" shall be followed. If sufficient time is not available for a planned shutdown, then each supervisor shall follow instructions from management, and secure the equipment for which he is responsible in the best manner possible under the circumstances.

DOCUMENT NO:	HSE-EAP-015	PAGE:	16 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

FREEZE PREPAREDNESS PLAN

A hard freeze is defined as the condition existing when temperatures remain below freezing for a period of 6 hours or more. If the possibility of a hard freeze is predicted, preventive measures must be taken to prevent damage to piping and equipment.

All lines subject to freezing must be protected. The cost of repair of even small water lines due to freeze damage can be a major expense both in terms of direct maintenance costs and production lost. Freeze damage, especially to smaller water lines, is virtually always preventable.

The preferred freeze protection method is to drain any line which is subject to freezing. **Allowing a water line to drip as a freeze preventive measure is permissible only as a last resort because dripping results in two serious problems. First, a safety hazard results from the ice formed on the ground or floor, and second, an additional load is placed on the water treatment facility since the dripped water must be collected and treated.**

When freezing conditions threaten, the area around any dripping water line (whether the drip is intentional or not) must be properly barricaded and marked as a hazardous area.

Additional precautions must be taken to protect other utility and process stream lines in the following types of service:

- Instrument air supply lines.
- Process stream and product lines containing product with freeze points, which may be affected by low ambient temperatures.
- Process stream and product lines containing high viscosity hydrocarbons or elemental sulfur.

Each department shall develop its own Freeze Protection Checklist so that operations personnel will be able to take effective preventive action when a hard freeze threatens.

ACTION: By October 31 of each year, each department manager with freeze protection responsibilities shall send the Emergency Management Coordinator written confirmation that the annual review of the department's Freeze Protection Checklist has been accomplished. This written confirmation shall include updated checklists, procedures and other information as appropriate.

DOCUMENT NO:	HSE-EAP-015	PAGE:	17 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

LIGHTNING THREATS

ROLES & RESPONSIBILITIES

Emergency Management Coordinator:

- Owner of this guideline and responsible for providing guidance toward its implementation.
- Initiates notification and training to affected personnel upon modifications to this guideline.

Main Gate Dispatcher:

- Monitors and gathers data from the ImpactWeather Guardian Lightning System.
- Notifies the Plant Shift Superintendent and provides storm / lightning strike specific data when lightning is within 15 and 7 miles of the refinery.
- Provides general announcements when lightning is within 7 miles of the refinery. At the discretion of the plant shift Superintendent, may provide general announcement when lightning has struck within 15 miles of the refinery.
- Provides "Return to normal activity" general announcements when lightning has not struck within 7 miles for 20 minutes.

Plant Shift Superintendent:

- Will acknowledge the lightning threat based on information provided by the Main Gate Dispatcher.
- Will have access to the ImpactWeather Guardian Lightning System to gain first hand knowledge of storm / strike specific data as required.
- Determines if a lightning hazard announcement should be initiated by the Main Gate Dispatcher when notified that lightning is within 15 miles of the refinery.

Supervision (Operations, Maintenance, Contractor):

- Responsible for the safety of their employees working in the refinery.
- Ensures their employees understand the appropriate response to the "7 mile" and "Return to normal activity" general announcements.

Houston Refining Employees and Contractors:

- Responsible for their personal safety while working in the refinery.
- Responsible for understanding the appropriate response for the "7 mile" and "Return to normal activity" general announcements.

PROCEDURAL GUIDELINES

Data Gathering

ImpactWeather will provide lightning threat information and lightning strike data to the refinery via the Main Gate Dispatcher. At various threat levels, ImpactWeather sends appropriate information to identified refinery personnel via email. The Main Gate

DOCUMENT NO:	HSE-EAP-015	PAGE:	18 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Dispatcher is the focal point for gathering lightning threat data and ensuring notifications are made to appropriate personnel when lightning is identified as a threat to the refinery.

ImpactWeather's Lightning Threat Predictor provides an indication that atmospheric conditions are such, or a known storm is moving so that lightning may occur within the identified threat area. The Lightning Threat Predictor serves as a prompt to initiate a higher level of awareness that lightning is possible within the threat area. ImpactWeather will issue a Lightning Alert via email when the Houston Refinery site is within the threat area. Upon receiving a Lightning Alert, the Main Gate Dispatcher will actively monitor the situation.

Action Points

The first "Action Point" for the Main Gate Dispatcher is a lightning strike within 15 miles of the refinery. Upon receiving notification that lightning has struck within 15 miles, the Main Gate Dispatcher will utilize the ImpactWeather Guardian Lightning System to determine the strike distance from the refinery, the relative location of the strike(s) in relation to the refinery, the direction that the storm which is producing lightning is moving, and the general density of lightning strikes that are being produced. The Main Gate Dispatcher then notifies the Plant Shift Superintendent and provides the information indicated above. Based on the information provided by the Main Gate Dispatcher, the Plant Shift Superintendent will acknowledge the potential lighting threat and recommend continued monitoring of the situation or proceeding to the second "Action Point" at this time.

The second "Action Point" for the Main Gate Dispatcher is a lightning strike within 7 miles of the refinery. Upon receiving notification from ImpactWeather, the Main Gate Dispatcher shall notify the Plant Shift Superintendent of the current situation and that they are going to make a 7 mile general announcement. Unless directed otherwise, the Main Gate Dispatcher will issue the following general announcement:

"This is a general announcement; there is lightning within 7 miles of the refinery.
This is a general announcement."

The third "Action Point" for the Main Gate Dispatcher is a 20 minute lapse without lightning within 7 miles. Upon receiving such notification from ImpactWeather, the Main Gate Dispatcher shall notify the Plant Shift Superintendent of the current situation and that they are going to make a general announcement to return to normal work activity. The Main Gate Dispatcher will then issue the following general announcement:

"This is a general announcement, there is no longer lightning within 7 miles of the refinery. Normal work activity may resume. This is a general announcement."

DOCUMENT NO:	HSE-EAP-015	PAGE:	19 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Work Curtailment Guidelines When Lighting is within 7 Miles of the Refinery

When a 7 or 15 mile general announcement is made, Operation's personal will continue with their normal duties while being cognizant of the hazards of open areas as listed below. Operation's First Line Supervision shall make the final decision to continue work based on the actual conditions at the work site.

When a 7 or 15 mile general announcement is made, all maintenance employees working in open / exposed areas should notify their supervisor that they are "Safing" up their current work. They should then seek shelter. Examples of open / exposed areas are, but not limited to:

- Confined spaces
- Crane work
- Tank Farms with no overhead equipment
- Docks with no overhead equipment
- Towers with no overhead equipment
- Top decks of structures with no overhead equipment

When a 7 or 15 mile general announcement is made, maintenance employees working in areas with overhead protection / equipment should continue working. Examples of overhead equipment / protection are, but not limited to:

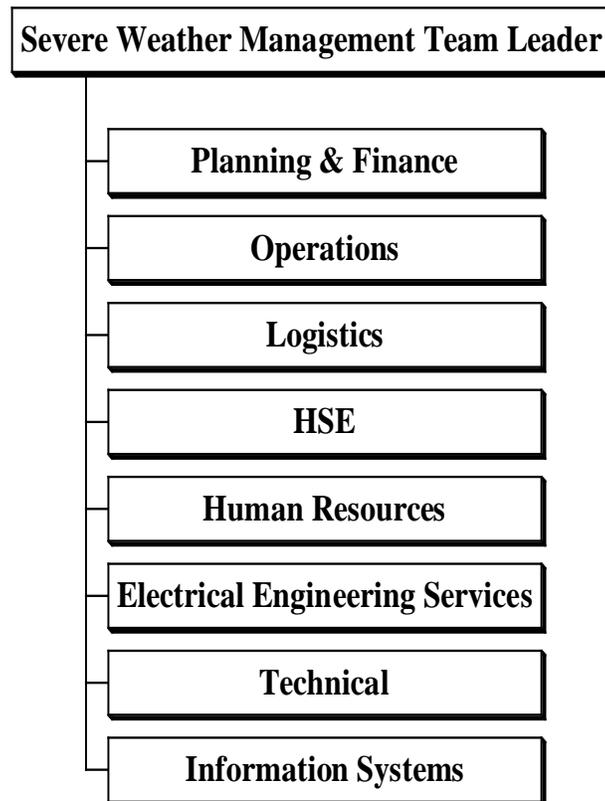
- Areas inside of operating units with structures above and around the area
- Compressor decks with roof structures
- Areas under overhead pipe racks or with overhead equipment
- Crane work with structures above and around the area
- Additional floors of structures
- Fan decks
- Temporary Fabrication shops

Maintenance supervision shall make the final decision to continue work based on the actual conditions at the work site.

DOCUMENT NO:	HSE-EAP-015	PAGE:	20 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

APPENDIX 1

Severe Weather Management Team Roles & Responsibilities



SEVERE WEATHER MANAGEMENT TEAM LEADER *See chart above*

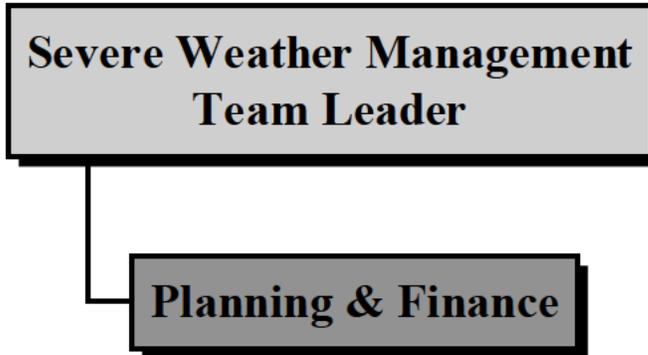
Assignment:	<ul style="list-style-type: none"> • Manager, Refining General
Alternate:	<ul style="list-style-type: none"> • Manager, Plant • Manager, Facilities
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Activates Severe Weather Management Team. • Advises team on where to report.
Reporting:	<ul style="list-style-type: none"> • Reports to owner companies.

DOCUMENT NO:	HSE-EAP-015	PAGE:	21 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Duties and Responsibilities: Severe Weather Management Team Leader
<ul style="list-style-type: none"> Exercises management control over the entire plant facility in response to severe weather.
<ul style="list-style-type: none"> Activates Severe Weather Management Team and calls preparedness meetings. Initiates hurricane preparedness program.
<ul style="list-style-type: none"> Reviews recommendations and plans, makes changes as necessary and authorizes their implementation.
<ul style="list-style-type: none"> Ensures contact with plant shift superintendents.
<ul style="list-style-type: none"> Specifies the time (based on the expected arrival of severe weather) for all standby personnel to be on site.
<ul style="list-style-type: none"> Chairs team meetings and conducts initial briefings.
<ul style="list-style-type: none"> Communicates to owners on severe weather management plans.
<ul style="list-style-type: none"> Reviews weather information, makes decisions and formulates actions to be taken related to plant status and preparation.

DOCUMENT NO:	HSE-EAP-015	PAGE:	22 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

PLANNING & FINANCE



Assignment:	<ul style="list-style-type: none"> • Manager, Optimization & Operations Planning
Alternate:	<ul style="list-style-type: none"> • Supervisor, Optimization & Operations Planning • Engineer, Consulting
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Report to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

Duties and Responsibilities: Planning & Finance	
<ul style="list-style-type: none"> • Provides management, consulting support, and evaluation information relating to financial, cost analysis, and risk management issues. 	
<ul style="list-style-type: none"> • Provides economic evaluations and manages feed stock logistics. 	
<ul style="list-style-type: none"> • Ensures appropriate handling of insurance matters. Post incident, manages damage assessment and control with appropriate functions. 	
<ul style="list-style-type: none"> • Ensures coordination of logistical issues focusing on customers. 	
<ul style="list-style-type: none"> • Provides information for development of predictions on incident potential. 	
<ul style="list-style-type: none"> • Ensures financing for logistics and supply issues are managed. 	
<ul style="list-style-type: none"> • Supports the organization in its mitigation and recovery efforts. 	

DOCUMENT NO:	HSE-EAP-015	PAGE:	23 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

<ul style="list-style-type: none"> • Ensures coordination of marketing, supply, and logistics functions as related to: <ul style="list-style-type: none"> • Customer/suppliers • Houston Refining-affected facilities • Pipelines and off-site terminals • Exchange partners • Railroad, truck, and marine transporters • Ensures appropriate communications with owners' financial officer, bankers and investors
<ul style="list-style-type: none"> • Advises the team on financial and supply matters. Provides information and follow-up related to funding decisions.
<ul style="list-style-type: none"> • Ensures financial information system support and recovery.
<ul style="list-style-type: none"> • Provides financial impact assessments and develops projections and forecasts related to the event.
<ul style="list-style-type: none"> • Participates in data gathering for analysis and subsequent planning efforts.
<ul style="list-style-type: none"> • Leads effort to ensure appropriate communications to customers relative to the crisis situation.
<ul style="list-style-type: none"> • Primary contact with industry technical consultants to communicate official information and updates. Works with Public Affairs on official information releases.

DOCUMENT NO:	HSE-EAP-015	PAGE:	24 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

OPERATIONS

Severe Weather Management Team Leader

Operations

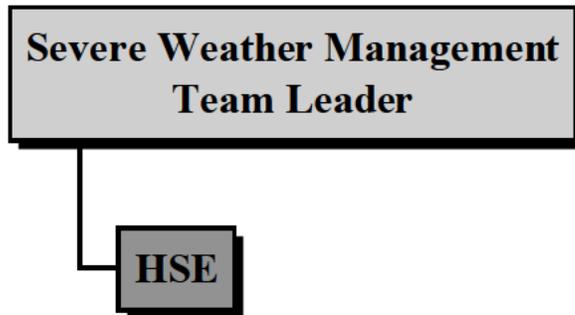
Assignment:	<ul style="list-style-type: none"> • Manager, Plant
Alternate:	<ul style="list-style-type: none"> • Assigned Area Superintendents
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Report to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

Duties & Responsibilities: Operations
<ul style="list-style-type: none"> • Manages plant-operating functions during severe weather.
<ul style="list-style-type: none"> • Coordinates operations activity such that minimal risk to employees and plant equipment is incurred during severe weather.
<ul style="list-style-type: none"> • Initiates annual hurricane preparedness program for respective areas.
<ul style="list-style-type: none"> • Reports status in accord with the severe weather checklist as decision points are reached and activities are accomplished.
<ul style="list-style-type: none"> • Plans for worst-case scenarios, such as reduced pipeline movements, marine receipts or shipments, or internal and external utility failures.
<ul style="list-style-type: none"> • Ensures and confirms standby personnel are established and ensures notifications are performed.
<ul style="list-style-type: none"> • Reviews status of operations support teams as activity develops. Ensures and verifies that appropriate staffing is arranged throughout and after the event.

DOCUMENT NO:	HSE-EAP-015	PAGE:	25 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

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| <ul style="list-style-type: none">• Communicates to operations superintendents and other operations personnel on preparation orders and status. |
| <ul style="list-style-type: none">• Coordinates employee related activities with Human Resources. |
| <ul style="list-style-type: none">• Ensures HSE and environmental engineer on-call are notified of plans to shutdown operations equipment. |
| <ul style="list-style-type: none">• Provides alternative action plans or recommendations for pollution control during a severe weather condition. |

DOCUMENT NO:	HSE-EAP-015	PAGE:	26 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

HSE

Assignment:	<ul style="list-style-type: none"> • Manager, HSE
Alternate:	<ul style="list-style-type: none"> • Manager, Emergency & Security Services • Other HSE Manager • Emergency Management Coordinator
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Report to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

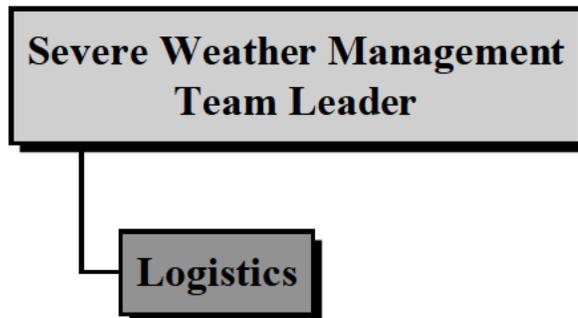
Duties & Responsibilities: HSE
<ul style="list-style-type: none"> • Manages and coordinates Health, Safety, Environmental and Security matters.
<ul style="list-style-type: none"> • Provides HSE and Emergency Management Response support for severe weather incident.
<ul style="list-style-type: none"> • Manages site security and ensures it is maintained. Coordinates site access and entry.
<ul style="list-style-type: none"> • Coordinates employee related activities with Human Resources.
<ul style="list-style-type: none"> • Maintains communications with local hospitals.
<ul style="list-style-type: none"> • Provides team with the most accurate and up-to-date weather information available.
<ul style="list-style-type: none"> • Advises the EOC staff on HSE matters.

DOCUMENT NO:	HSE-EAP-015	PAGE:	27 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

- Assists Logistics in the provision of alternative action plans or recommendations for pollution control during a severe weather condition.
- Provides environmental coordination with outside agencies, such as the General Land Office and the Coast Guard.
- Ensures proper environmental agency notifications are performed in a timely fashion.
- Provides for and coordinates Medical Department services during severe weather conditions and stand-bys.

DOCUMENT NO:	HSE-EAP-015	PAGE:	28 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

LOGISTICS



Assignment:	<ul style="list-style-type: none"> • Manager, Facilities
Alternate:	<ul style="list-style-type: none"> • Assigned Manager • Assigned Superintendent
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Reports to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

Duties & Responsibilities: Logistics
<ul style="list-style-type: none"> • Manages and coordinates all supply and maintenance support activities during severe weather situations.
<ul style="list-style-type: none"> • Coordinates appropriate maintenance superintendents and personnel and equipment to ensure services are provided where required during an emergency.
<ul style="list-style-type: none"> • Ensures that the necessary supplies (fuel, ropes, flashlights, provisions, etc.) are available during severe weather when the plant is isolated from outside support.
<ul style="list-style-type: none"> • Coordinates pre-severe weather check-out of critical equipment (generators, portable pumps, etc.).
<ul style="list-style-type: none"> • Ensures required maintenance coverage for duration of the emergency.
<ul style="list-style-type: none"> • Coordinates employee related activities with Human Resources.

DOCUMENT NO:	HSE-EAP-015	PAGE:	29 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

<ul style="list-style-type: none">• Ensures provision of bedding and other supplies for stand-by and emergency response personnel.
<ul style="list-style-type: none">• Ensures pre-severe weather preparations are implemented and that stand-by and start-up support are available.
<ul style="list-style-type: none">• Coordinates with maintenance superintendents to ensure repair of plant equipment.
<ul style="list-style-type: none">• Coordinates the supply of support services and resources.
<ul style="list-style-type: none">• Ensures inspection for structural integrity of equipment and facilities is performed and makes appropriate recommendations.
<ul style="list-style-type: none">• Serves as liaison with contractors to assure compliance with company procedures.
<ul style="list-style-type: none">• Through Purchasing, supports other team members with outside procurement services and other vendor related coordination as needed.

DOCUMENT NO:	HSE-EAP-015	PAGE:	30 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

HUMAN RESOURCES

Severe Weather Management Team Leader

Human Resources

Assignment:	<ul style="list-style-type: none"> • Manager, Human Resources
Alternate:	<ul style="list-style-type: none"> • Manager, Labor Relations • Other assigned HR Manager
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Reports to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

Duties & Responsibilities: Human Resources
<ul style="list-style-type: none"> • Manages and coordinates all human resources matters.
<ul style="list-style-type: none"> • Administers employee pay policies as they relate to severe weather stand-by and non-essential personnel.
<ul style="list-style-type: none"> • Provides emergency messages to employees.
<ul style="list-style-type: none"> • Reviews plant employee needs with other coordinators.
<ul style="list-style-type: none"> • Maintains "head count" of stand-by personnel with emergency notification information (holder of master call-out list).
<ul style="list-style-type: none"> • Provides personnel information to the EOC as needed.
<ul style="list-style-type: none"> • Provides employee assistance as necessary.
<ul style="list-style-type: none"> • Activates Human Resources Team as appropriate.

DOCUMENT NO:	HSE-EAP-015	PAGE:	31 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

ELECTRICAL ENGINEER SERVICES

**Severe Weather Management
Team Leader**

Electrical Engineer Services

Assignment:	<ul style="list-style-type: none"> • Superintendent, Maintenance Electrical
Alternate:	<ul style="list-style-type: none"> • Assigned Principal or Senior Engineer
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Report to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

Duties & Responsibilities: Electrical Engineer Services	
<ul style="list-style-type: none"> • Manages and directs all use and support of communications, instrumentation and electrical support for the facility. 	
<ul style="list-style-type: none"> • Coordinates with appropriate maintenance superintendents and instrument and electrical maintenance personnel. 	
<ul style="list-style-type: none"> • Coordinates engineering personnel and equipment to ensure services are provided where required during severe weather. 	
<ul style="list-style-type: none"> • Provides electrical engineering support to damage, loss and repair projects. 	
<ul style="list-style-type: none"> • Ensures that in-plant communications equipment remains operative. 	
<ul style="list-style-type: none"> • Coordinates with maintenance superintendents to ensure required maintenance coverage for duration of severe weather. 	
<ul style="list-style-type: none"> • Ensures that scheduled preventive maintenance is performed on all communications equipment in the EOC and that repairs are made promptly. 	
<ul style="list-style-type: none"> • Ensures maintenance superintendents coordinate employee related activities with Human Resources. 	

DOCUMENT NO:	HSE-EAP-015	PAGE:	32 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

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DOCUMENT NO:	HSE-EAP-015	PAGE:	33 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

<ul style="list-style-type: none">• Ensures maintenance superintendents maintain location of all electrical and instrumentation maintenance personnel for the duration of the incident.
<ul style="list-style-type: none">• Contacts and makes arrangements for additional communications, instrumentation and electrical support personnel as directed by the Severe Weather Management Team Leader.
<ul style="list-style-type: none">• Assumes responsibility for facility electrical utilities outside of unit boundaries.
<ul style="list-style-type: none">• Arranges for repair and other support services to plant mobile radio equipment.
<ul style="list-style-type: none">• Ensures pre-severe weather inspection of radio equipment in EOC, the Main Gate and the Command Van (Mobile Command Post) is performed.
<ul style="list-style-type: none">• Ensures assembly of instrument, electrical and radio service staff as necessary to support emergency effort.
<ul style="list-style-type: none">• Ensures that emergency power is maintained to EOC for critical communications equipment.

DOCUMENT NO:	HSE-EAP-015	PAGE:	34 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

TECHNICAL

Severe Weather Management Team Leader

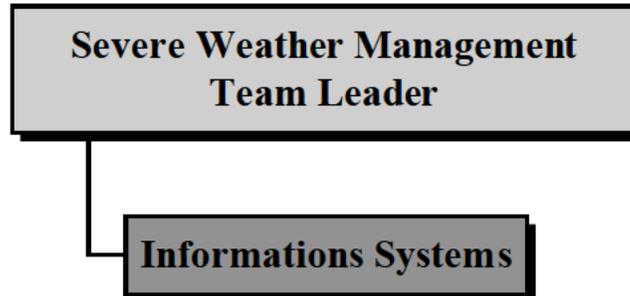
Technical

Assignment:	<ul style="list-style-type: none"> • Manager, Technical
Alternate:	<ul style="list-style-type: none"> • Assigned Manager, Technical • Assigned Superintendent, Technical
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Report to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

Duties & Responsibilities: Technical
<ul style="list-style-type: none"> • Manages process-engineering support.
<ul style="list-style-type: none"> • Fulfills requests for process engineering support. Coordinates and assigns direct process technical support to operating units.
<ul style="list-style-type: none"> • Provides process unit support relating to stand-by, shutdown or start-up conditions.
<ul style="list-style-type: none"> • Coordinates employee activity with Human Resources.
<ul style="list-style-type: none"> • Provides for field support to operating units as necessary.
<ul style="list-style-type: none"> • Assembles process engineering superintendents and staff as necessary to support effort.

DOCUMENT NO:	HSE-EAP-015	PAGE:	35 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

INFORMATION SYSTEMS



Assignment:	<ul style="list-style-type: none"> • Manager, Computing Operations
Alternate:	<ul style="list-style-type: none"> • Assigned Manager, IS • Assigned Supervisor, IS
Notification:	<ul style="list-style-type: none"> • Emergency Management Pager System
Response:	<ul style="list-style-type: none"> • Report to EOC or as directed when team is activated.
Reporting:	<ul style="list-style-type: none"> • Reports to Severe Weather Management Team Leader.

Duties & Responsibilities: Informations Systems
<ul style="list-style-type: none"> • Manages securing of information systems and other related equipment.
<ul style="list-style-type: none"> • Takes steps necessary to secure and protect data stored in information systems and ensures copies of all data are stored in a pre-arranged, safe location remote from the plant site.
<ul style="list-style-type: none"> • Coordinates employee activities with Human Resources.
<ul style="list-style-type: none"> • Arranges for computer services to be provided from an alternate site during and after the event as necessary.

DOCUMENT NO:	HSE-EAP-015	PAGE:	36 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

APPENDIX 2: STORM TERMINOLOGY

SAFFIR-SIMPSON HURRICANE SCALE					
STORM CATEGORY	WIND VELOCITY	SURGE (FEET)		DAMAGE	EFFECTS
		COAST	BAYS		
One	74-95 MPH Winds	4-5	4-7	Minimal	Minimal damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also some coastal road flooding and minor pier damage.
Two	96-100 MPH Winds	6-8	8-12	Moderate	Some roofing material, door, and window damage to buildings. Considerable damage to vegetation mobile homes, and piers. Small craft in unprotected anchorages break moorings.
Three	111-130 MPH Winds	9-12	13-18	Extensive	Structural damage to small residences and utility buildings with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris.
Four	131-155 MPH Winds	13-18	19-24	Extreme	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Major damage to lower floors of structures near the shore.
Five	>155 MPH Winds	18+	24+	Catastrophic	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or awry. Major damage to lower floors of all structures located less than fifteen (15) feet above sea level.

DOCUMENT NO:	HSE-EAP-015	PAGE:	37 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

HURRICANE TERMS	
TERM	DEFINITION
Tropical Wave	A trough of cyclonic curvature maximum in the trade-winds easterlies. The wave may reach maximum amplitude in the lower troposphere. Showers and thunderstorms occur on the east side of the wave-axis as the wave moves to the west.
Tropical Disturbance	A discrete system of apparently organized showers and thunderstorms that originates in the tropics or subtropics and maintains its identity for twenty four (24) hours or more. It may or may not be associated with a detectable perturbation of the wind field (tropical wave)
Tropical Depression	An organized system of clouds and thunderstorms with a defined counterclockwise circulation (in the Northern Hemisphere) and maximum sustained wind speeds of 38 MPH (33 knots) or less.
Tropical Storm	An organized system of strong thunderstorms with a defined circulation and maximum sustained wind speeds of 39 to 73 MPH (34 to 63 knots). The storm is now given a name.
Hurricane	An intense tropical weather with a well-defined circulation and maximum sustained winds speeds of 74 MPH (64 knots) or higher. The term "hurricane" is used for Northern Hemisphere cyclones from east of the International Dateline to the Greenwich Meridian.
Hurricane Watch	Conditions pose a possible threat to the watch area within 24 hours <i>IMPORTANT NOTE: From the area of highest landfall prediction, hurricane watches have a probability of error of 150 nautical miles. .</i>
Hurricane Warning	Sustained winds of 74 MPH or higher are expected in the warning area within 24 hours or less. <i>IMPORTANT NOTE: From the area of landfall prediction, hurricane warnings have a probability of error of 90 nautical miles.</i>

DOCUMENT NO:	HSE-EAP-015	PAGE:	38 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

**APPENDIX 3
HURRICANE PREPAREDNESS
PHASE 1 - PRE-SEASON CHECKLIST**

PHASE 1 activities must be completed by June 15th of each year. Their completion must be documented and sent to the refinery Emergency Management Coordinator.

ACTIVITY PHASE 1	RESPONSIBILITY
General	
<input type="checkbox"/> Survey all guy wires and identify the need for additional guy wires. (Stacks, cooling tower fan stacks, flares, etc.)	<input type="checkbox"/> Manager Operations Safety and Reliability - Inspection Group to perform engineering survey <input type="checkbox"/> Unit Survey - Plant Managers
<input type="checkbox"/> Make a list of all temporary or portable buildings, tanks and other non-permanent structures that should be "anchored" to the ground. The list shall be forwarded to Facilities Management.	Plant survey and provision of list: <input type="checkbox"/> Buildings – Manager Facilities <input type="checkbox"/> Unit survey - Plant Managers
<input type="checkbox"/> Make a list of all temporary or portable tankage or containers that should be "anchored" to the ground. The list shall be forwarded to the Maintenance Manager.	Plant survey and provision of list: <input type="checkbox"/> Buildings – Manager Facilities <input type="checkbox"/> Unit survey - Plant Managers
<input type="checkbox"/> Survey all metal coverings and roofing for likelihood of being blown loose. Have necessary repairs made.	<input type="checkbox"/> Plant Managers
<input type="checkbox"/> Coordinate all contractor preparations. Review checklists and follow-up on completion.	<input type="checkbox"/> Manager Maintenance <input type="checkbox"/> Manager Projects
<input type="checkbox"/> Review critical feedstock / raw material supplier hurricane plans to ensure alignment	<input type="checkbox"/> Plant Managers
Operations	
<input type="checkbox"/> Review and revise operations functional shutdown plans. <input type="checkbox"/> Test Calpine operations interface from CCRB	<input type="checkbox"/> Plant Managers
Information Services	
<input type="checkbox"/> Review and revise information services functional shutdown, data management and security plans.	<input type="checkbox"/> Manager Computing Operations, Alternate Manager Information Services

DOCUMENT NO:	HSE-EAP-015	PAGE:	39 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Electrical and Standby Equipment	
<input type="checkbox"/> Survey ALL fixed emergency generating, UPS and other electrical standby equipment.	<ul style="list-style-type: none"> ➤ Manager Maintenance ➤ Manager Facilities
<input type="checkbox"/> Check <u>portable</u> generators for operability. Store in Yard Tool Room and operate weekly. <input type="checkbox"/> Provide list of all portable generators <input type="checkbox"/> Review assessment of required portable generators.	<ul style="list-style-type: none"> ➤ Manager Maintenance
<input type="checkbox"/> Ensure extra nitrogen (trucks) is procured and available to facilitate unit shutdowns.	<ul style="list-style-type: none"> ➤ Manager Procurement & Materials
<input type="checkbox"/> Survey all emergency and standby Instrument Air Compressors and Air Systems.	<ul style="list-style-type: none"> ➤ Plant Managers
Environmental and Flood Control	
<input type="checkbox"/> Ensure that outfalls are clean and outfall meters are properly calibrated.	<ul style="list-style-type: none"> ➤ Plant Managers
<input type="checkbox"/> Survey drainage and make sure all sewers and drainage ditches are in good order. Assure that all sump pumps are in working order.	<ul style="list-style-type: none"> ➤ Unit Survey - Plant Managers ➤ Outside Boundary Limits – Superintendent Utilities
<input type="checkbox"/> Survey the need for sump pumps (steam tunnels, C&P basement, and Main Office basement).	<ul style="list-style-type: none"> ➤ Manager Facilities
<input type="checkbox"/> Review assessment of requirements for portable pumps. <input type="checkbox"/> Set up or review commitment for standby portable pumps.	<ul style="list-style-type: none"> ➤ Plant Managers ➤ Manager Procurement & Materials
<input type="checkbox"/> Fill sand bags (see number below).	<ul style="list-style-type: none"> ➤ Manager Maintenance
Standby Personnel	
<input type="checkbox"/> Identify and review minimal requirements for standby personnel (amount required).	<ul style="list-style-type: none"> ➤ All Superintendents report to respective Plant Manager. ➤ Emergency Management Coordinator provides list for Emergency Response Personnel.

DOCUMENT NO:	HSE-EAP-015	PAGE:	40 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Provisions and Supplies	
<ul style="list-style-type: none"> <input type="checkbox"/> Provide provisions for stand-by personnel to sustain a stay of at least: <ul style="list-style-type: none"> ▪ Category 1,2, & 3 Storm: 2 - days ▪ Category Upper 3 and all 4 & 5 Storms: 5 - days <input type="checkbox"/> Provisions must include: <ul style="list-style-type: none"> Sleeping arrangements Food and water Nomex clothing Other items as necessary 	<ul style="list-style-type: none"> ➤ Manager Maintenance ➤ Manager Facilities
<ul style="list-style-type: none"> <input type="checkbox"/> Provide ample supply of rain gear, flashlights and flashlight batteries (available at Storehouse Tool room). 	<ul style="list-style-type: none"> ➤ Manager Procurement & Materials

TOTAL SANDBAG REQUIREMENTS

Total Planned for Buildings and Substations	2,220
STANDBY	500
TOTAL	2,720

DOCUMENT NO:	HSE-EAP-015	PAGE:	41 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

APPENDIX 4

HURRICANE PREPAREDNESS PHASE 2 CHECKLIST

Phase 2 activities must be completed and documentation sent to the Emergency Management Coordinator.

ACTIVITY - PHASE 2	RESPONSIBILITY
General	
<input type="checkbox"/> Survey all guy wires and need for additional guy wires (stacks, cooling tower fan stacks and flares).	➤ Plant Managers
<input type="checkbox"/> Survey all metal coverings and roofing for likelihood of being blown loose and have necessary repairs made.	➤ Plant Managers ➤ Manager Facilities
<input type="checkbox"/> General cleanup campaign. Eliminate ALL loose objects at ALL levels.	➤ Plant Managers ➤ Manager Facilities
<input type="checkbox"/> Tie down ALL temporary or portable buildings, tanks and other non-permanent structures that should be "anchored" to the ground. Those in the vicinity of critical equipment, such as transformer stations should be prioritized.	➤ Plant Managers ➤ Manager Facilities
<input type="checkbox"/> Secure all drums, scaffold material, etc., that could be blown by high wind. Where possible, tie loose items into large bundles. All drums not being used should be removed from operating units.	➤ Plant Managers
<input type="checkbox"/> Port-a-cans should be tied down or moved to a sheltered area.	➤ Plant Managers ➤ Maintenance Manager
<input type="checkbox"/> Ensure contractor preparations are completed.	➤ Manager Maintenance ➤ Manager Projects
<input type="checkbox"/> Trash dumpsters should be emptied and kept as empty as possible.	➤ Plant Managers
<input type="checkbox"/> Review Phase 3 Checklist and initiate action on each item at the appropriate time to assure completion before the arrival of sustained 40 mph winds.	➤ Plant Managers
<input type="checkbox"/> Review recovery rental equipment list. Reconcile list with equipment that is already on site	➤ Manager Maintenance
Operations	
<input type="checkbox"/> Test Calpine operations interface from CCRB	➤ Plant Managers
<input type="checkbox"/> Make FINAL preparations on fixed emergency generating, UPS and other electrical standby equipment. Fill with fuel.	➤ Plant Managers
<input type="checkbox"/> Ensure adequate staffing to Lock out CT fans and connect anti-rotation devices on all CT fans upon total unit shutdowns	➤ Plant Managers
Electrical and Standby Equipment	
<input type="checkbox"/> Make FINAL preparations on fixed emergency generating, UPS and other electrical standby equipment. Fill with fuel.	➤ Plant Managers ➤ Manger Facilities
<input type="checkbox"/> Ready all portable generator equipment. Fill with fuel. <input type="checkbox"/> Provide FINAL list of all portable generators	➤ Manager Maintenance
<input type="checkbox"/> Make FINAL arrangements for extra nitrogen (trucks) to facilitate unit shutdowns.	➤ Manager Procurement & Materials
Storage Tanks	
<input type="checkbox"/> Plan to fill all ground level tanks at least 30% full. Use water if necessary.	➤ Plant Managers
<input type="checkbox"/> No floating roof tanks should have any part of roof showing above the tank wall.	➤ Plant Managers

DOCUMENT NO:	HSE-EAP-015	PAGE:	42 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

ACTIVITY - PHASE 2	RESPONSIBILITY
Environmental and Flood Control	
<input type="checkbox"/> Survey drainage and make sure all sewers are draining and in good order. Check sump pumps.	➤ Plant Managers
<input type="checkbox"/> Ready all sump pumps (steam tunnels, C&P basement, and Main Office basement).	➤ Plant Managers
<input type="checkbox"/> Install all sandbags.	➤ Manager Facilities
Emergency Response	
<input type="checkbox"/> Ready all emergency response equipment and personnel.	➤ Manager HSE
Standby Personnel	
<input type="checkbox"/> Select and confirm FINAL LIST of standby personnel. Provide a list of standby personnel to Human Resources.	➤ All Superintendents report to respective Plant Manager ➤ Emergency Management Coordinator provides list for Emergency Response Personnel
Provisions and Supplies	
<input type="checkbox"/> Ensure FINAL supplies of rain gear; flashlights and flashlight batteries are on-hand (available at Storehouse).	➤ Manager Procurement & Materials
<input type="checkbox"/> Ensure FINAL provisions are made for stand-by personnel to sustain a stay of at least: <ul style="list-style-type: none"> ▪ Category 1,2, & 3 Storm: 2 - days ▪ Category Upper 3 and all 4 & 5 Storms: 5 - days <input type="checkbox"/> Provisions must include: <ul style="list-style-type: none"> Sleeping arrangements Food and water Nomex clothing Other items as necessary 	➤ Maintenance Manager ➤ Manager Facilities
<input type="checkbox"/> Purchase adequate supplies of gasoline and road grade diesel fuel to sustain expected needs through potential electrical outages	➤ Manager Facilities
<input type="checkbox"/> Obtain and initiate custody of petty cash per LYO Hurricane Preparedness On-Hand Cash policy http://ion/ohc/treasury/Word/CashMgmt/Hurricane%20Preparation-%20Cash%20Advance.doc	➤ Manager Accounting Services ➤ Manager Facilities

DOCUMENT NO:	HSE-EAP-015	PAGE:	43 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

**FLOOD PREVENTION LIST
SANDBAGGING CHART
MANAGER PLANT SERVICES RESPONSIBILITY**

The following table provides the building locations which require sand bagging, the number of sand bags required at each site, and information on the placement of sandbags.

Unless otherwise indicated, the bagging locations at each site (the third column in the chart) are doors and the number listed is the number of doors. If the bagging location is not a door, it is so indicated.

SANDBAG LOCATIONS

SITES REQUIRING SAND BAGGING	QUANTITY REQUIRED	BAG PLACEMENT
Main Office Basement	53	2
Main Office Computer Room	40	2
Main Air Compressor	154	2
225 TKFM Oily Water Sewer	88	Pump Slab
BRU WS Pump house	84	3
BRU Control Room	45	2
BRU Switchgear Room	104	4
674 TK Pump (E of Fluid)	58	Pump Slab
SRU Control Bldg	100	3 (plus 2 portable pumps)
SRU Switchgear Room	21	2
SRU 100 Ton Switch Gear Room	50	2
ARU Switchgear Rooms (2)	22	2 (by C.R.)
ARU Switchgear Rooms (2)	14	2(N of PHSE 1)
733 Control Room	47	4
C&PS Loading Dock	95	Railroad
BTU WS (735 CTPPHSE)	36	2
Coker Naphtha	36	2
631 Control Room	31	2
Coker Switchgear (by CR)	26	2
ARU CT Pump house	102	3
Gulf Coast Station	15	2
NMPCT Pump house W Door	23	1
Fluid Antimony	65	Reservoir
Air Compressor #4 & #5 Motors	85	
Boiler House Office	27	
C&P Stairway (MTY Drum Bldg.)	30	
C&P Basin Flipper Valves	50	
NMP Switch Gear Room	37	2
MEK Switch Gear Room	50	
533 Switch Gear Room	37	
#2 Water Treatment Plant S. Gr. Room	37	
MEK Cooling Tower Door	47	
Dock Office	30	
Compressor House	46	2

DOCUMENT NO:	HSE-EAP-015	PAGE:	44 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

SUBSTATION SANDBAG REQUIREMENT

SITES REQUIRING SAND BAGGING	QUANTITY REQUIRED	BAGGING LOCATIONS
#712 (685 & 230 Gas)	26	2
LPG Load Center	18	2
#312	40	2
#412 & #512	60	4
#7 Sub	100	2
#612 Sub	100	2
#1A (B.H.)	70	2
#2 (Heavy Oil Office)	21	2

DOCUMENT NO:	HSE-EAP-015	PAGE:	45 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

APPENDIX 5

HURRICANE PREPAREDNESS PHASE 3 CHECKLIST

Phase 3 activities must be completed and documentation sent to Emergency Management Coordinator.

ACTIVITY PHASE 3	RESPONSIBILITY
General	
<input type="checkbox"/> All booms, cranes, dock booms, etc., should be lowered and secured. All gantries should be secured.	➤ Equipment Owner
<input type="checkbox"/> Ensure that all firewall drains are closed.	➤ Tank Owner
<input type="checkbox"/> Check all floating roof tank drains. If any roof drain is not working, it must be repaired immediately. (If a roof drain is blocked off, a heavy rain will sink the roof.)	➤ Tank Owner
<input type="checkbox"/> Protect all non-reinforced glass by taping, boarding up, etc.	➤ Maintenance Manager
<input type="checkbox"/> Plug drain holes and partially fill trash dumpsters with water.	➤ Maintenance Manager
<input type="checkbox"/> Establish 6 Work Orders for recovery efforts. 5 for Asset Teams, and 1 for Plant General	➤ Accounting
<input type="checkbox"/> Fill all in-plant fuel station storage tanks and fuel trucks that are on site	➤ Maintenance Manager
<input type="checkbox"/> Obtain recovery rental equipment that is not already on site	➤ Maintenance Manager
<input type="checkbox"/> Establish Recovery Work Orders. 1 for each Asset Team and 1 for plant General	➤ Maintenance Manager
Information Services	
<input type="checkbox"/> Back up data systems and prepare to shutdown as necessary	➤ Manager Computing Operations, Alternate – Manager Information Services
Electrical and Standby Equipment	
<input type="checkbox"/> Place portable generators in place per operations orders. Install all necessary electrical connections.	➤ Maintenance Manager
<input type="checkbox"/> Fill all trucks and other equipment with fuel. (Gasoline cannot be pumped during a power failure.) Fill 55-gallon drums and have hand pumps available.	➤ Equipment Owner
Emergency Response	
<input type="checkbox"/> Provide safe storage for oil spill boat.	➤ HSE Manager
<input type="checkbox"/> Move oil spill boom and other oil spill pickup equipment to safe location.	➤ HSE Manager
<input type="checkbox"/> Move all emergency response apparatus (fire apparatus, etc.) to safe and logistically proper locations.	➤ HSE Manager
Operations	
<input type="checkbox"/> Remove all exposed and non-supported pressure gauges. Pressure gauges are especially vulnerable to being blown off, which can result in breakage of the associated small piping.	➤ Equipment Owner
<input type="checkbox"/> Ensure that all Cooling Tower Fans are locked out and that Anti-Rotation devices are installed on all fans.	➤ Ops & Maintenance

DOCUMENT NO:	HSE-EAP-015	PAGE:	46 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Plant Elevators	
<input type="checkbox"/> Cover ventilation louvers on all elevator penthouses to keep storm rain out. Remove the covers as soon as possible after the storm to re-establish adequate ventilation.	➤ Equipment Owner
<input type="checkbox"/> Stop all elevators in position at second floor landings. Do not operate elevators during storm.	➤ Equipment Owner
Standby Personnel	
<input type="checkbox"/> At the completion of Phase 3, release all non-standby and non-essential personnel. Put standby personnel in place.	➤ All Managers

DOCUMENT NO:	HSE-EAP-015	PAGE:	47 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Appendix 6: Planning and Personnel Staffing Plan



Planning and
Personnel Staffing Plan

Appendix 7: Hurricane Preparedness Timeline



Hurricane
Preparedness Timeline

Appendix 8: Operations Circulation/Shutdown Timing



Operations
Circulation / Shutdown

Appendix 10: Employee Emergency Tracking Form



Employee Emergency
Tracking Form

DOCUMENT NO:	HSE-EAP-015	PAGE:	48 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

APPENDIX 9

Refinery total Circulation / shutdown Guideline

Last saved: 4/11/2013 1:42 PM

Timing for evacuation

Proper timing in the release and reporting of various personnel groups is essential to help ensure employee safety and adequate facility preparation. The following times are used as a guide for release and reporting. Times indicated are in advance of the predicted arrival of 40 mph sustained winds.

- NOTE: Suppliers plan:
 - N2 –
 - Air Products (top off N2 storage tanks)
 - PraxAir – will maintain N2 supply
 - Hydrogen –
 - PraxAir – will be shutdown 36 hours before landfall
 - Air Products – will maintain H2 supply (300 mile pipeline)
 - **Channelview**
 - Natural Gas –
 - Houston Pipeline – Will maintain NG supply
 - Midcon – will maintain NG supply
 - Coastal Water Authority (CWA) – Raw Water (Will not S/D, may be forced down)
 - Electricity/Steam/Boiler Feed Water/Clarified Water – Calpine S/D plan will match our plan – will continue to monitor process from CCRB
- ❖ 108 Hours – (4.5 days)
 - Operations – Transition operations (all shifts) to 7 – 12's
 - If Shutdown/Startup (SU/SD) Teams are not filled with volunteers, operations to draft employees as needed to meet refinery SU/SD needs
- ❖ 96 Hours – (4 days)
 - Release SU/SD Team and Ride-out Team for home and family preparation
- ❖ 72 Hours – (3 days)
 - Begin the staggered release of non-essential personnel (non ops)
 - Release Assessment Team for home and family preparation
- ❖ 60 Hours – (2.5 Days) **Critical decision on going to min refinery rates and initiating Shutdown of specific listed**
 - Operations – Take refinery to minimum rates with operating personnel not on SU/SD Team
 - Crude rate @180MBD
 - 736/737 Cokers on 4 drum minimum operation based on resid
 - Shutdown 534 Depent, 632 HDS begins processing full range Coker Naphtha
 - Shutdown 630 HDS and begin hot hydrogen sweep. All 536 WWD and 537 Kero to 631 HDS
 - FCCU to min rate – 65MBD

DOCUMENT NO:	HSE-EAP-015	PAGE:	49 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

- ❖ **48 Hours – (2 Days) Critical decision for taking refinery to total circulation**
 - SU/SD Team and Ride out Team report for storm duty
 - Operations – Take all units to total circulation, besides the FCC.
 - The FCC needs to start the shut down process at 48 hours.
 - Release of operations personnel who are not on SU/SD Team / Ride-out Team as unit operational status allows.
- ❖ **36 Hours – (1.5 Days) Critical decision for continued circulation or shutdown**
 - Operations - Take all refinery units to cold state.
 - Release of remaining operations personnel who are not on Ride-out Team as shutdowns are completed
- ❖ **0 – 12 Hours**
 - Final preparations
 - Ride out team in place – no personnel in the field

3rd party vendors of anticipated changes:

- 3rd Party H₂ suppliers
 - Praxair: (800) 926-9620 and hit “1” for the control room
 - Air Products: (281) 478-7562
 - Channelview: (281) 452-8421
- 3rd Party NG suppliers
 - Houston Pipeline: (800) 392-1956
 - Midcon (Kinder Morgan): (713) 769-9200
- Contact CWA for projected water usage to let them know we will be reducing our consumption: (281) 424-2312
- PP delivery – Enterprise: (281) 385-4239 or (713) 667-9431
- BB delivery to Channelview: (281) 452-8399 (tank farm)
- LPG Pipeline: (281) 452-8420 (CHO) and (918) 660-4458 (BP Pipeline)
- Calpine – Communicate consumption/production changes in steam, water, electrical, and the loss of high and low pressure gas. Ensure that Calpine has enough 35% HCL and membrane grade caustic to last for a few days. (713) 456-1338 or (713) 456-1345
- The COC will remain operating until fuel gas is no longer available.
- FCCU O₂ supply and Nitrogen delivery for the Plant – Praxair (listed above)
 - Fill both nitrogen bullets at the MAG and the SRC

Other administrative actions required prior to refinery circulation:

- Notify the Environmental on-call representative for any HSE concerns during shutdown.

DOCUMENT NO:	HSE-EAP-015	PAGE:	50 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Critical Issues:

- Make sure that product streams are diverted to slop or off-test tank(s) prior to going off-test. Verify all stream line-ups to ensure no tanks are contaminated. Document all changes in C-Notes. **Protect product tank qualities.**
- Monitor all release stream temperatures. **Protect tank temperatures within the established normal ranges.**
- Monitor releases to tanks for vapor flows. Ensure all slop and pump-out systems have good liquid seals.
- Block in amine circulation to/from units as they shutdown. Notify the SRC console operator prior to blocking in circulation.
- The PSS will coordinate all shut down activities and communicate all issues and status updates as needed. Additional help may be required at the CCRB for the PSS.
- This guideline does not replace SOPs and EOPs but should be used as a checklist for plant wide issues and logistics.

Cutter for shut down:

- During the shut down process as we lose cutter supply (LCO, Crude Unit diesel or kerosene will not be available) from the process units. We will have to line up 882-TK (LCO) to the FCCU plot edge where it will be routed to the treated and untreated cutter systems. The following link will open a diagram illustrating the mentioned line-up.

[LCO from 882 to Cutter System](#) **NEED TO FIND LINK**

- A minimum inventory of 30MB of LCO should be maintained in 882 tk during hurricane season. If LCO from 882-TK is unavailable an alternate supply of cutter can be lined up from 609-TK to the low and high-pressure cutter systems once the FCCU is shutdown.
- When 736 shuts down (when 737 is down) the HP cutter pumps will need to be operated to supply cutter to 736 via the 737 cutter system. The HP cutter system can only be routed directly to 737.

Shut down sequence: This is not an all-inclusive list of activities. Unit specific shut-down procedures should be utilized. Shutdown sequence starts with crude rates at min of 180 MBD and Coker running at 4-drum minimum rates. Crude and Coker operations need to coordinate/alternate usage of 550 and 125 steam systems during the shutdown process.

1. Start raising reactor temperatures on 439 Claus units per unit shutdown SOP's to allow for improved heat soak during shutdown process. Repeat this step on all other Claus units
2. 537 Crude Unit and 737 Coker will begin shutting down first. 737 Coker will need to flush their system with 736 CLGO during shut down activities. Remember to divert product streams to slop as they go off-test.

DOCUMENT NO:	HSE-EAP-015	PAGE:	51 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

3. 537 Crude Unit will begin reducing rate and heater firing in order to segregate the Crude and Vacuum Towers prior to circulating both sides. The crude tower will release long resid to the Cokers and resid tankage prior to going on total circulation. Follow the regular unit shut-down SOP.
 - CTOH, diesel and kerosene products will be routed to slop as they go off-test. Evaluate the tank levels and control flow rates in order to manage tank capacities.
 - Vacuum gas oils (LVGO, MVGO, and HVGO) will dump down the tower as vacuum is broke. Continue releasing VGO streams to 594-TK until draw trays are at minimum levels and release resid to 813/814-TK until the vacuum tower is on total circulation.
4. 737 Coker will reduce rate and trip one heater. Stay on long resid as long as necessary
 - Route coker naphtha to hot mix spheres. This requires taking both 736 and 737 Naphtha streams to the spheres (534 Depent should already be down).
 - Bring 632 HDS to circulation as feed becomes low in 585 and 815 tks.
 - Route CLGO/CHGO to 891-TK upon bypassing the 2nd heater.
 - Start flushing cutter (at 537 Crude unit) down the hot feed line once the second 737 heater is bypassed. Route the 537 hot feed line to 801/813/814-TK through the HIC line and 736 hot feed blending area.
5. As the crude and coker units shutdown, the HDS units will begin losing feed and will need to go on partial/total circulation per unit SOP's.
6. The FCCU will be reducing rate during this time and will get down to all cold feed prior to bypass. As the FCCU reduces rates their console operator will need to notify the HDS console operator that they will be stopping hot feed. At this point the HDS console operator should maximize their cold product release to ensure 594-TK does not get too hot. Both consoles will work together to manage 594-TK temperatures.
7. 533 Lubes complex will be reducing rates and going on total circulation. Remember to protect product tanks and follow unit shut down SOP's. Transfer oil as necessary into empty tanks to prevent them from floating if storm presents flooding issues.
8. Approximately 4 hours into the shut down process, begin reducing 536 feed rates and heater firing in order to segregate the Crude and Vacuum Towers prior to circulating both sides. The Crude Tower will be releasing long resid to the Cokers and resid tankage prior to going on total circulation. Follow the regular unit shut down SOP.
 - CTOH, diesel and WWD products will be routed to slop (584 tk) as they go off-test. Evaluate the tank levels and control flow rates in order to manage tank capacities.
 - Vacuum gas oils (LVGO and HVGO) will dump down the tower as vacuum is broke. Continue releasing VGO streams to 594-TK until draw trays are at minimum levels and release resid to 813/814-TK until the vacuum tower is on total circulation.
 - NOTE: Ensure HP Cutter is lined up to Hot/Cold Resid Release lines to Coker/Resid Tks

DOCUMENT NO:	HSE-EAP-015	PAGE:	52 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

9. 736 Coker will reduce feed rates and clear the first heater (6 hours) through a coking drum per SOP. As soon as stable switch to a clean drum with open vents and steam to atmosphere. Following this move, bypass the other heater. Route products to slop as they go off-test and follow the regular unit shut down SOP. **CAUTION: Start the shut-down and bypass procedure on the heater with at least 4 hours of coking since the last switch to prevent having a drum containing un-coked material.**
 - Naptha should already be going to hot mix tanks
 - Route CLGO/CHGO to 891 TK
 - Start flushing (at 536 Crude unit) down the coker hot feed line once the second 736 heater is bypassed. Route the 536 feed line to 813/814-TK through the 736 hot feed blending area.
10. The HDS units will have lost all feed at this time and will be on circulation or hot hydrogen sweep. Remember, all HDS units will have their product lines diverted to off-test tanks by Oil Movements.
 - 630 already sweeping, product release to 609-TK
 - 631 HDS on circulation, product release to 609-TK
 - 632 HDS (OP-400 line) to 618-TK
 - 633 and 635 HDS to 609-TK
 - 634 and 636 HDS should continue maximizing their cold release to the FCCU to protect 594-TK temperatures.
 - 637 HDS to 674-TK
 - **CAUTION: Monitor release temperatures and tower levels closely to protect tanks.**
11. The FCCU will be at minimum rate processing all cold feed and will bypass the reactor. Continue catalyst circulation and start torch oil into the regen to maintain temperature. Float the gas plant on the firing line and low line per SOP.
12. The FCCU blower will remain in operation until the combustor needs to be shutdown. At this point catalyst off-loading will begin on the Regen side and the blower will be shut down.
13. As the FCCU shuts down 637 HDS will lose feed and will need to go on partial/total circulation per SOP.
14. 733 LEF and 735 Unifiner will have been reducing rate and pulling feed from tank as they lose feed from the crude units. Divert Unifiner product to 11/850 tanks. Once feed is lost from the crude units, both towers will be shut down. Adequate H₂ should be available from 3rd party suppliers to sweep and circulate on the Unifiner system.
15. Shut down the BTU Depent as feed is lost. Divert btms product stream to OP-400.
16. 230 Gas Plant will pace the Refinery as much as possible. There will be excess low line gas as units depressure, but will eventually decrease as units go on total circulation and/or shutdown.
17. The BRU towers will be placed on total reflux as feed is lost.
18. The SRU will begin shutting down amine circulation.

DOCUMENT NO:	HSE-EAP-015	PAGE:	53 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

19. The SRU will continually reduce rates as Refinery DEA gas make decreases.
- The Claus units will go on natural gas assist firing and eventually total natural gas firing as rates decrease further.
 - Shut down 439 Claus Unit before 433 and 434 as these units are smaller and will be able to handle lower amounts of DEA Regenerator gas.
 - The TGU's will go on circulation with 440 TGU on recycle blower operation.
 - 435 TGU will remain on line as long as possible with 433 or 434 processing DEA gas.
 - When process gets too low to operate 435, swing all gas to 440, which has a recycle blower.
 - As gas loads allow, shut down 433 and 434 units according to normal unit shut down SOP's.
20. 230 and 236 Gas Plants will be the last Units to shutdown.
- NOTE: Amine circulation will determine timing of 230 and 236 shutdowns

Operations Shutdown Time Line (begins approx 48 hours prior to 40 mph winds)

- From 0-4 hours:
 - 537 Crude Unit goes on circulation. Cutter flows established in hot and cold lines. 635 and 631 HDS units on circulation.
 - 737 Coker; one heater on circulation and one cleared
- From 4-8 hours:
 - 536 Crude Unit on circulation. Cutter flows established in hot and cold lines.
 - 736 Coker; one heater on circulation and one cleared
 - FCCU at minimum rate on all cold feed and preparing to bypass the reactor
 - HDS units on hot H₂ sweep
 - Unifiner shuts down
 - BT Depent down (if running), BRU on reflux/circulation
 - SRU 439 Claus and TGU down, 433 and 434 on natural gas assist
 - Lube Complex will be down.
- After 12-16 hours:
 - All units lined out on total circulation.

DOCUMENT NO:	HSE-EAP-015	PAGE:	54 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

Plan for Total Refinery Shutdown

- All heaters, pumps, fin-fans, and cooling towers will be shutdown.
- All compressors should be shutdown except on 230 Gas Plant. Shutdown lube oil circulation pumps per procedure.
- Leave coker Fractionator bottoms circulation pumps running
- For heaters: Double block and bleed all fuel and pilot gas. Trip SIS systems as available and field verify.
- Leave flare purges in place
- Leave flare pilots in service
- De-inventory FCCU Catalyst
- Shutdown 236 Gas Plant
- Close Coke drum bottom heads. **Fill coke drums ~50% with water and leave vents open.** Lower the Ideco's all the way into the drum and secure Ideco's and top heads.
- Fill storage tanks with water per procedure
- Shutdown 230 compressors as gas loads allow
- Alarm Management - As units are brought down, unit alarms must be managed in one of the following two ways.
 - Note: Unit alarms cannot be shutdown across the board as they were last year.

DOCUMENT NO:	HSE-EAP-015	PAGE:	55 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

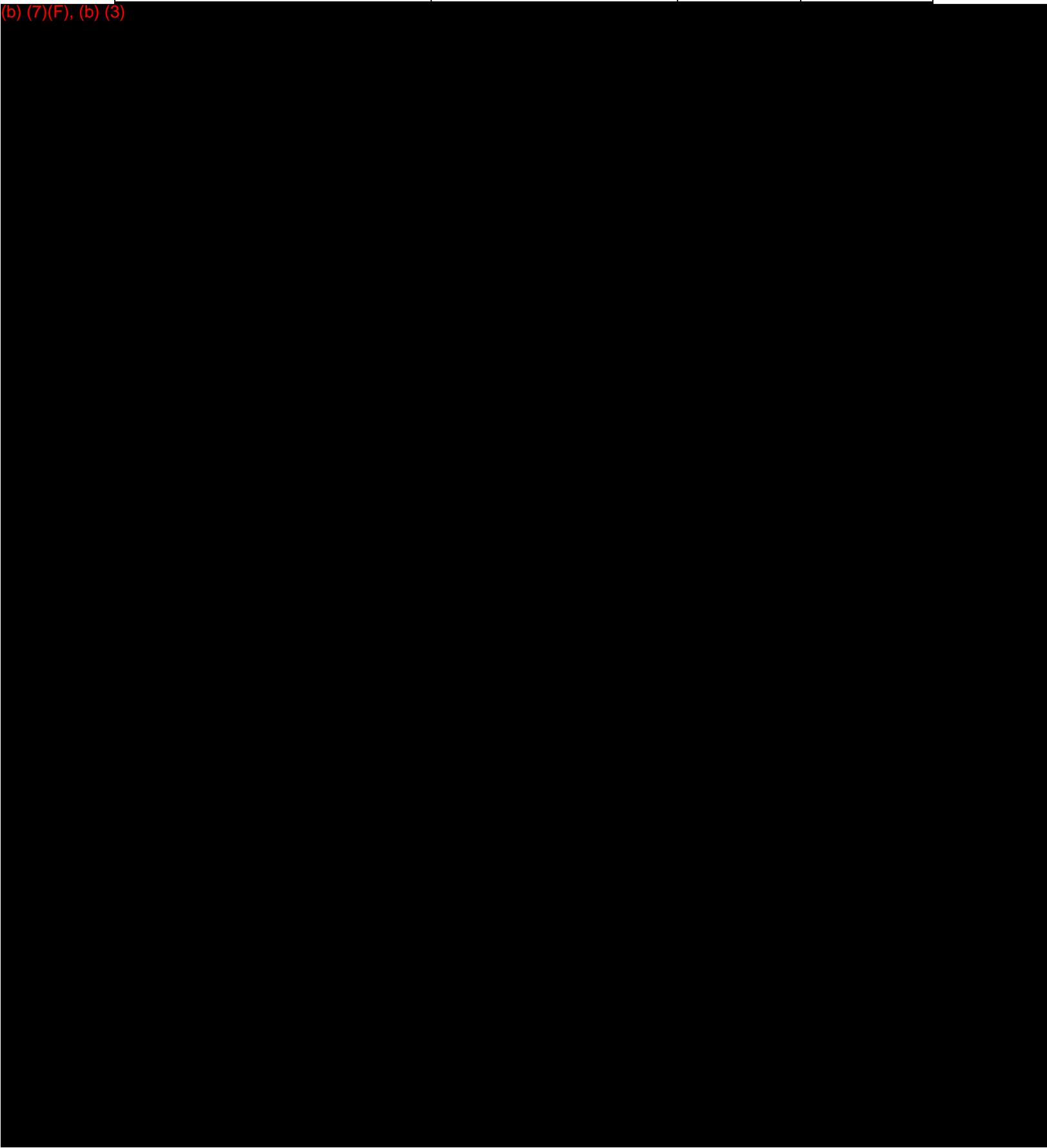
Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	
6/28/2012	J. Windham	Inserted revised Appendix 9 – Total Refinery Circulation / Shutdown Plan	

DOCUMENT NO:	HSE-EAP-015	PAGE:	56 OF 56
DOCUMENT NAME:			
SEVERE WEATHER MANAGEMENT PLAN			

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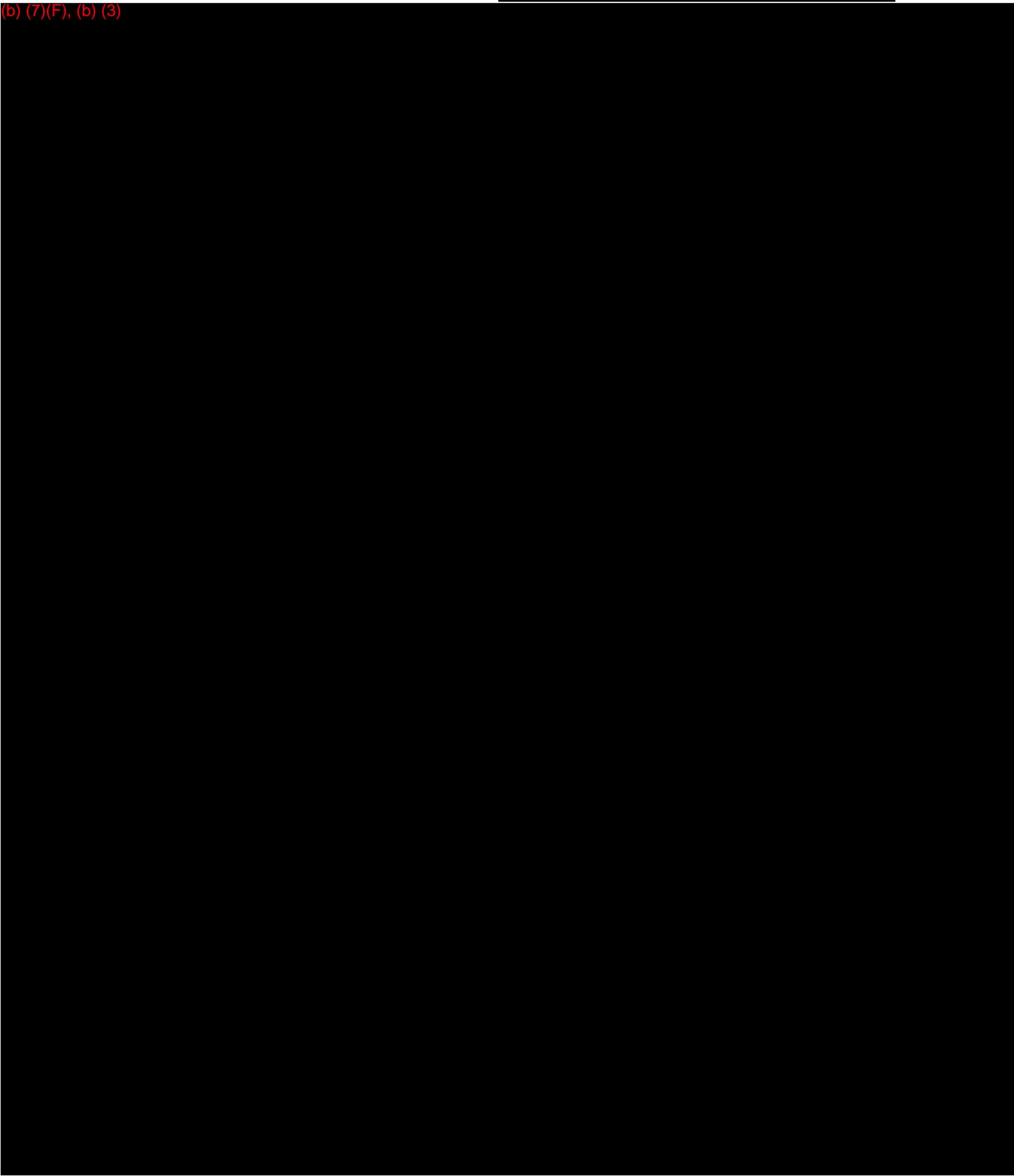
HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-019	Page: 1 OF 7	Approval Date:	06/30/2011
Document Title:	BOMB THREAT PROCEDURES				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>			Effective Date:	07/01/2011
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>			Review Date:	02/24/2011

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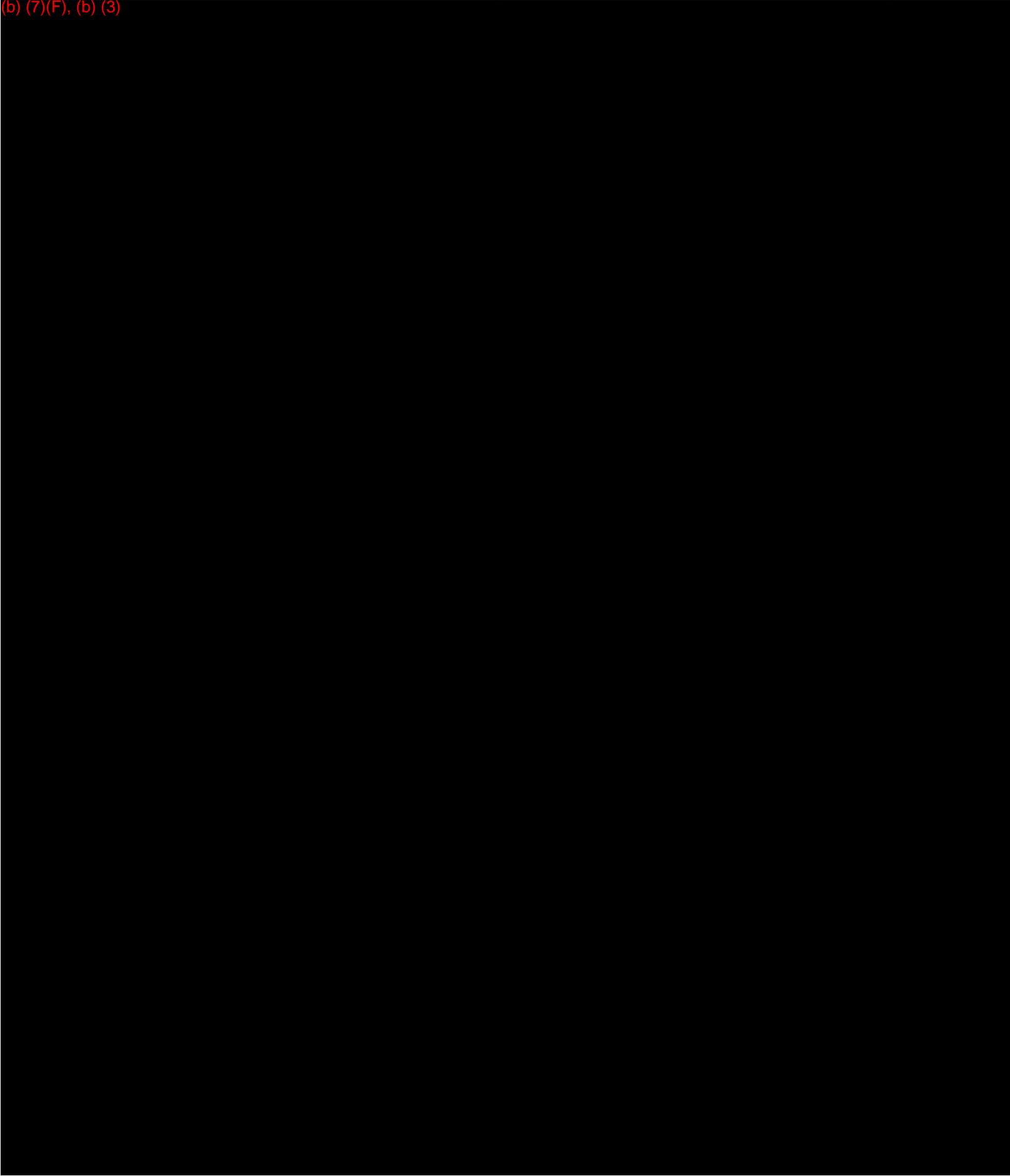
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DOCUMENT NAME:			
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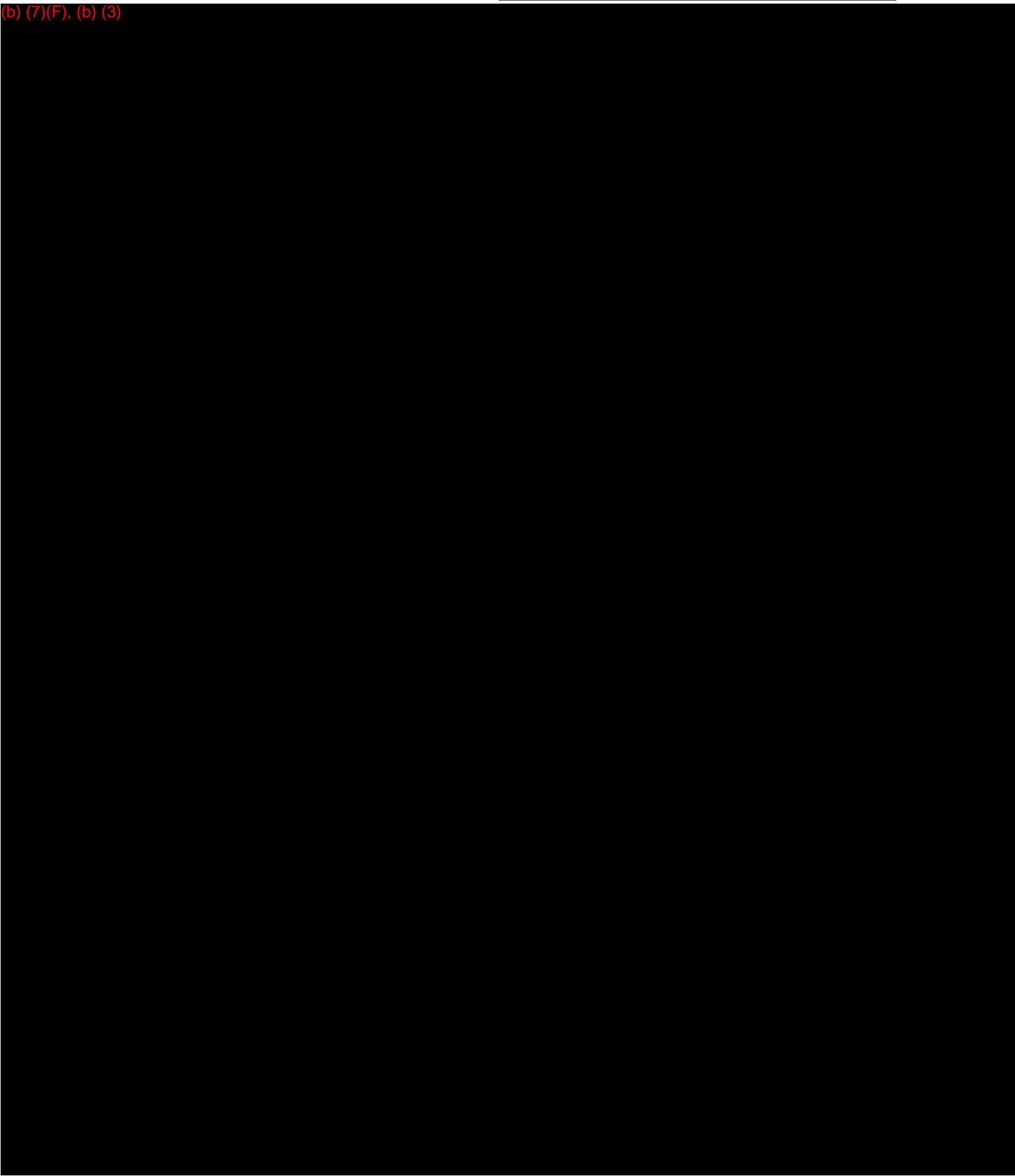
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DOCUMENT NAME:	BOMB THREAT PROCEDURES		

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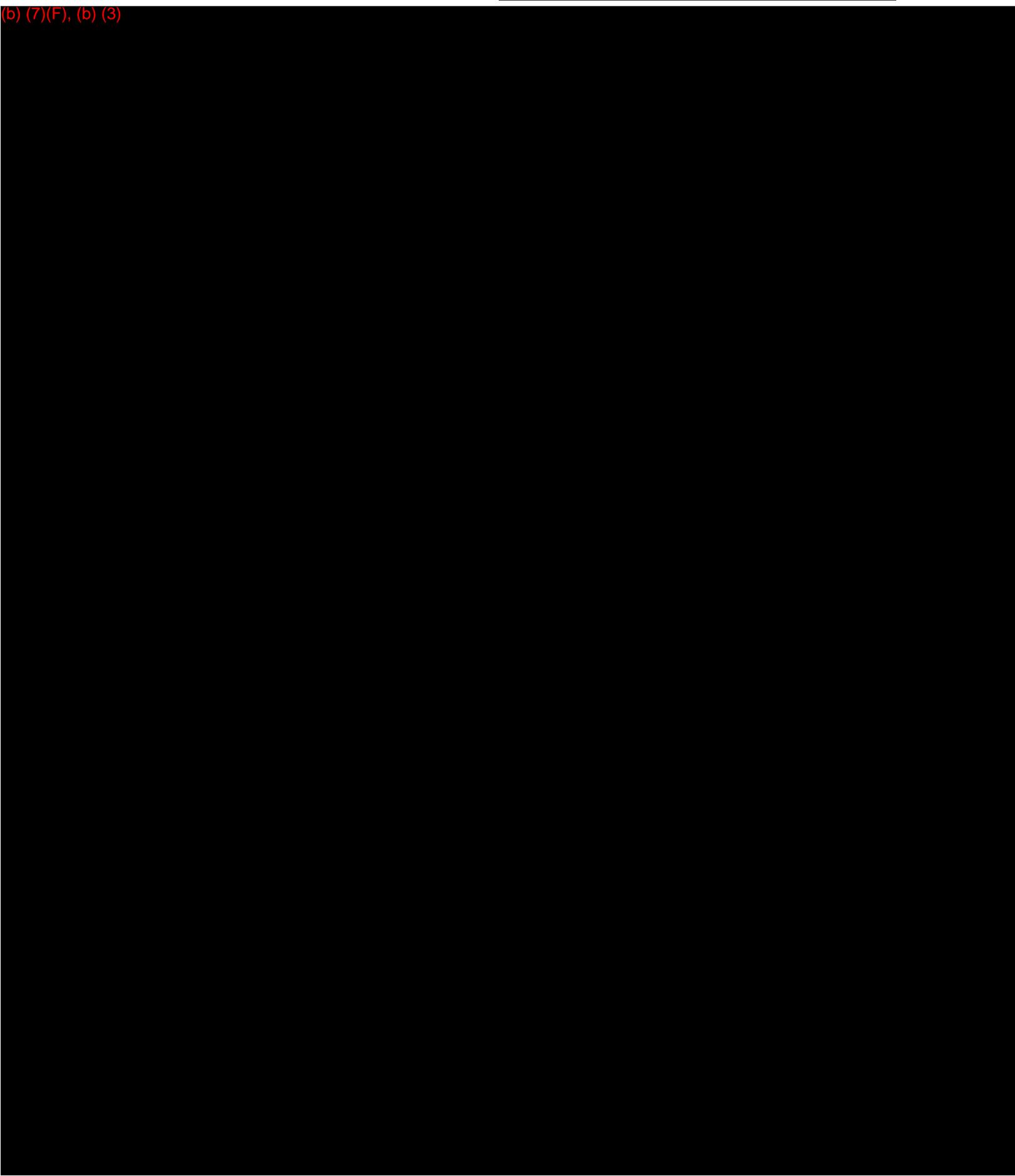
DOCUMENT NO:	HSE-EAP-016	PAGE:	4 OF 7
DOCUMENT NAME:			
BOMB THREAT PROCEDURES			

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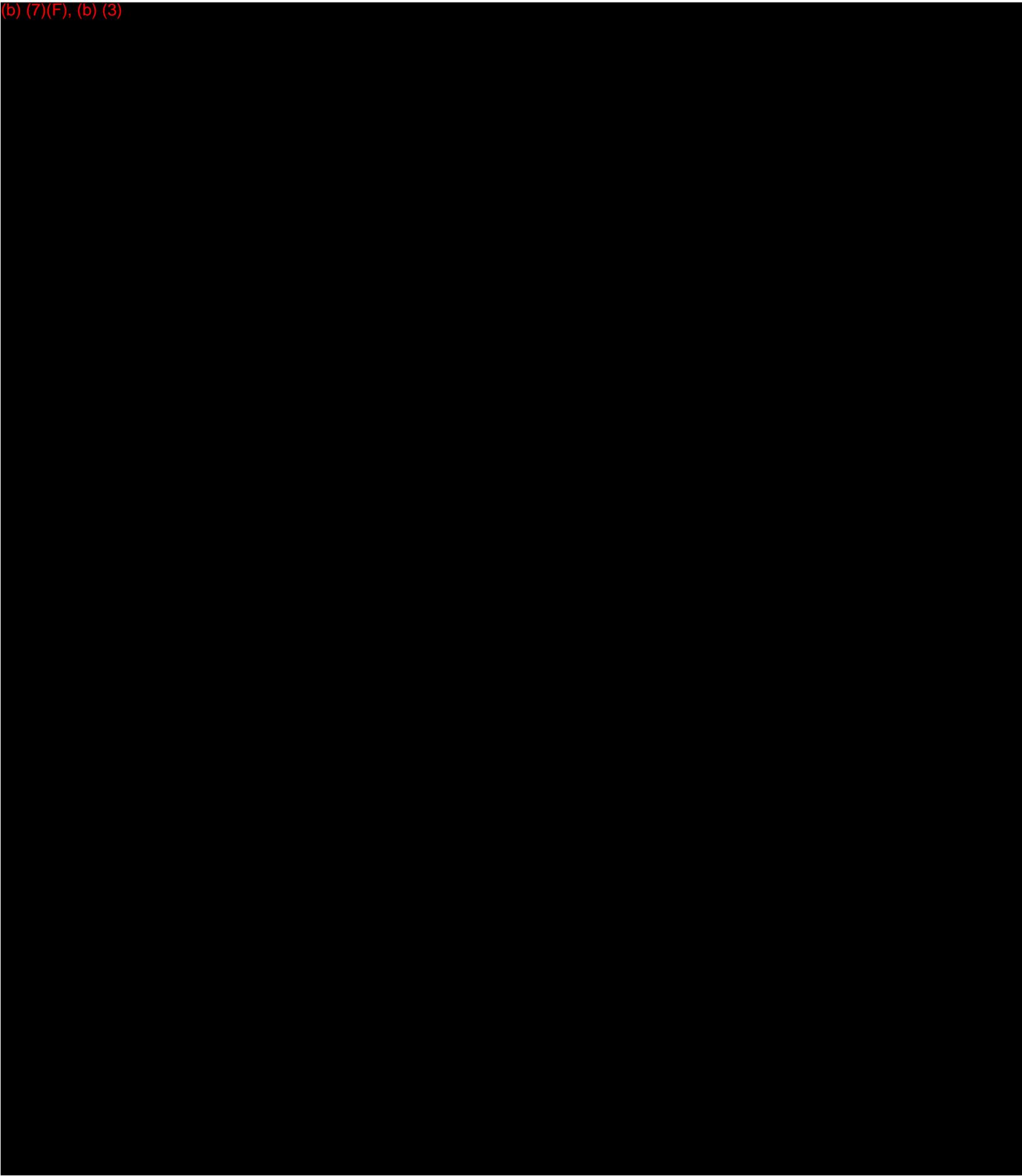
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DOCUMENT NAME:			
BOMB THREAT PROCEDURES			

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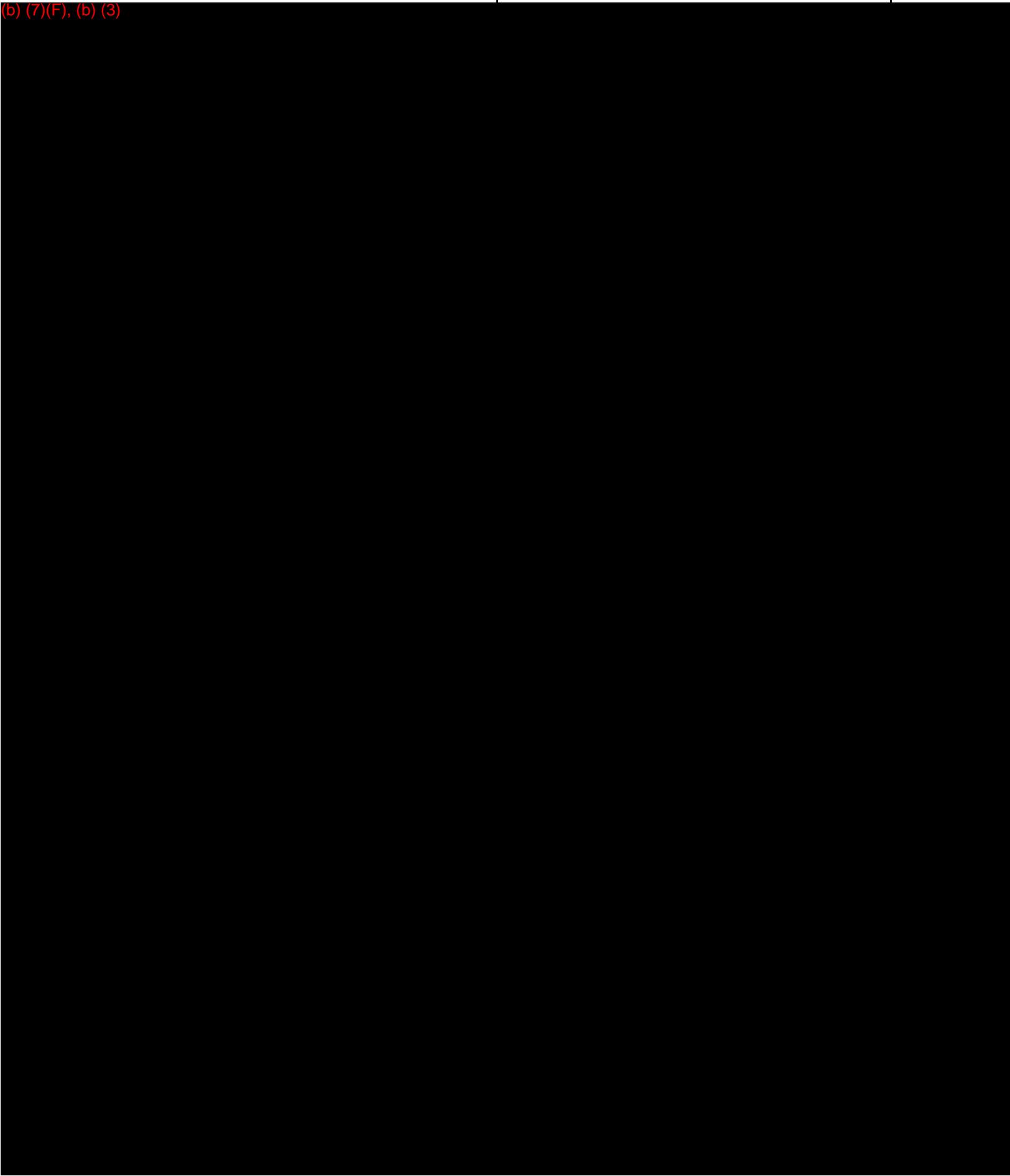
DOCUMENT NO:	HSE-EAP-016	PAGE:	6 OF 7
DOCUMENT NAME:			
BOMB THREAT PROCEDURES			

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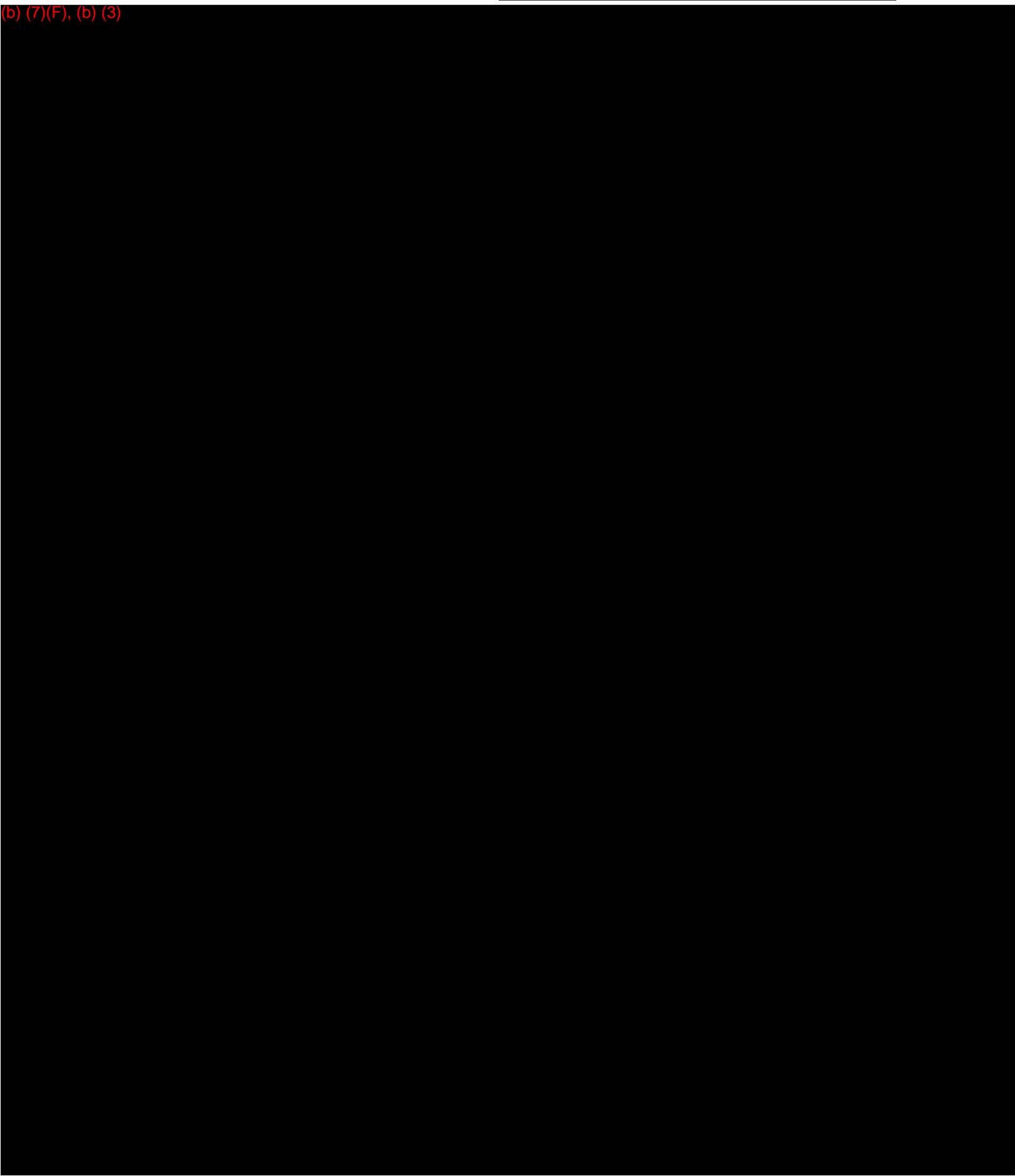
DOCUMENT NO:	HSE-EAP-016	PAGE:	7 OF 7
DOCUMENT NAME:			
BOMB THREAT PROCEDURES			

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DOCUMENT NO:	HSE-EAP-017	PAGE:	2 OF 3
DOCUMENT NAME:			
CIVIL DISTURBANCE			

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HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP 021	Page: 1 OF 24	Approval Date:	06/30/2011
Document Title:	PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE				
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TABLE OF CONTENTS

Summary	2
Scope and References	2
Definitions	2
Roles and Responsibilities	4
Procedure	5
Training	9
Appendix 1: Pandemic Preparedness Checklist	10
Appendix 2: Pandemic Minimum Staffing Guidelines	17
Appendix 3: Appendix D to OSHA 1910.134 – Employee Disclosure for Voluntary Use of Respirators	21
Revision Summary	24

DOCUMENT NO:	HSE-EAP-018	PAGE:	2 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

SUMMARY

The purpose of the plan is to provide guidelines to preparedness and response measures that should be considered during a pandemic episode that may impact business and operation at the Houston Refinery site. The goal is to reduce the possibility for disease transmission and maintain an effective level of business continuity.

SCOPE & REFERENCES

This procedure applies to all employees, contract personnel and visitors at the Houston Refinery.

- The following documents relate to this procedure
- Corporate Management System Guideline – Pandemic Preparedness & Response
- United States Centers for Disease Control
- United States Department of Homeland Security
- Occupational Safety and Health Administration

DEFINITIONS

Pandemic – Multiple epidemic outbreaks of an infectious disease that is spreading through the worldwide human population.

Pandemic Flu – A virulent flu that causes a global outbreak of the illness. Because there is little natural immunity, nor a vaccine or limited amounts of vaccine, the disease can spread easily from person to person.

Seasonal (or common) Flu – A respiratory illness that can be transmitted from person to person. Most people have some type of immunity, and a vaccine is available.

Non-essential Personnel – Personnel who can work remotely or who can miss two weeks of work without creating significant disruptions to plant operations in the short-term.

World Health Organization (WHO) – The World Health Organization is the United Nations specialized agency for health whose objective is the attainment by all peoples of the highest possible level of health.

DOCUMENT NO:	HSE-EAP-018	PAGE:	3 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

WHO Pandemic Alert System – The alert system utilized by the WHO to inform the world of the level of pandemic threat. LBI utilizes the WHO as a reference for implementation of the LBI Pandemic Preparedness and Response Plan. A change in the WHO’s alert level to Level 4 will initiate the LBI plan. While the WHO’s system will reflect the global status, the company understands that all parts of the world may not be impacted at the same time. Therefore, implementation of actions at the Houston Refinery will be based on local episodic conditions that could directly impact the refinery.

WHO Alert Level	Description	Trigger
1	Inter-pandemic phase. New virus in animals, no human cases	Low risk of human cases
2		Higher risk of human cases
3	Pandemic alert. New virus causes human cases	No or very limited human-to-human transmission
4		Evidence of increased human-to-human transmission
5		Evidence of significant human-to-human transmission
6	Pandemic	Efficient and sustained human-to-human transmission

DOCUMENT NO:	HSE-EAP-018	PAGE:	4 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Lyondellbasell Pandemic Stage Level – The LBI specific plan that specifies the preparedness / response actions to be considered based on local episodic conditions that are currently are have a potential to impact the refinery.

LBI Level	Stage	Description/Trigger
0		WHO moves to the global pandemic phase level 4
1		Confirmed community transmission in your region (Americas, AP/ME, EU)
2		Spread throughout your region or multiple cases in your country
3		Widespread outbreaks in your country or multiple locations in your locale
4		Current confirmed case involving your facility
5		Absenteeism at / beyond critical levels

Facility Pandemic Focal Point – The individual responsible for coordinating the development and assisting with implementation of this preparedness and response plan.

Facility Pandemic Response Team – A cross-functional team consisting of:

Manager(s) – Plant
 Manager – HSSE
 Manager – Health & Safety
 Manager – Emergency Services & Security
 Manager – Human Resources
 Facility Medical Director
 Facility Pandemic Focal Point
 Others as deemed appropriate

ROLES AND RESPONSIBILITIES

HSSE Manager

- Ensuring the information in this procedure is communicated to employees and contractors.
- Overseeing the response and implementation of action plans when alert levels are raised.
- Reviewing local conditions and discussing with corporate HSE as needed.

Managers, Superintendents and Supervisors

DOCUMENT NO:	HSE-EAP-018	PAGE:	5 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

- Ensuring delivery of official communications and implementation of actions as directed within their area of responsibility when the alert level is raised.
- Reporting information on employees with known pandemic illness like symptoms to the Facility Pandemic Focal Point or Medical

Employees

- Follow the requirements that are implemented as a result of this plan in response to a potential pandemic situation.
- Reporting pandemic illness like symptoms to the Facility Pandemic Focal Point or Medical.

Facility Pandemic Focal Point

- Coordinates the development of the refinery pandemic preparedness and response plan and assist the HSSE Manager in implementation of the plan.
- Communicate with Regional Pandemic Focal Point on behalf of the refinery.

Facility Pandemic Response Team

- Implements the refinery specific pandemic preparedness and response plan.

PROCEDURE

ALERT / STAGE LEVEL GUIDELINES

The recommendations of this plan are provided as guidance toward activity to consider at various stages of pandemic threat. This plan does not require progression from one alert / stage level to the next. The measures referenced in Attachment 1 may be accelerated, delayed or implemented in multiple steps based on local episodic conditions of the illness.

[Attachment 1](#) – Pandemic Preparedness Checklist contains specific items / actions that should to be considered at each of the Pandemic Stage Levels.

WHO Alert Level 3

- Declaration of WHO Alert Level 3 initiates the LBI Pandemic Preparedness measures.
- Local actions at this phase consist primarily of validation of plans and minimum staffing levels, preparation of employee communications, acquisition of infection control supplies and planning for expanded telecommuting.
- Corporate HSE will monitor recognized health organizations to determine the extent of threat to various LBI business regions.
- Refinery HSSE will establish a pandemic specific communication link with corporate via the Regional Pandemic Focal Point.

DOCUMENT NO:	HSE-EAP-018	PAGE:	6 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

WHO Alert Level 4 / LBI Stage Level 0

Declaration of WHO alert Level 4 initiates the LBI Pandemic Response Plan at LBI Stage Level 0. Local action at this phase consists of a final check of plans and implementation of initial employee communications. Typical communication mechanisms at this level will be via Pipeline and email distribution.

- Convene initial meeting of the Facility Pandemic Response Team to review plans and initiate action as dictated by the situation.
- Monitor the situation via regional/local governmental health agencies to assess the necessary response level and make adjustments as determined necessary.
- Establish communication links with key outside entities such as, suppliers, customers, contractors, etc. The intent of these discussions is to become aware of key entity plans that may adversely impact refinery operations. Adjustments to the refinery plan may become necessary based on the information received.
- Validate plans to include minimum staffing levels (Attachment 2) and essential business functions.

LBI Stage Levels 1, 2 and 3

LBI Stage Levels 1 & 2 are initiated as there is an increase in spread of the target pandemic illness throughout the Americas Region. Level 3 is initiated as widespread outbreaks of the illness occur in the United States, or significant case spread is confirmed locally. Highlights of activity to be considered at Stage Levels 1 & 2 include:

- Continue to assess the local situation to determine if local escalation of the Stage Level is appropriate.
- Continue employee communications. Intensify as dictated by escalation of the illness.
- Educate personnel on the signs and symptoms associated with the target pandemic illness.
- Implement measures to minimize potential spread of the illness within the refinery environment.
- Encourage personnel to stay at home if they begin to show signs & symptoms of the illness, or have a fever. Employees who suspect they have had the illness should not return to work until 24 hours after they are free of a fever without the use of fever reducing medications.

LBI Stage Level 4

LBI stage Level 4 is initiated when a refinery employee or resident contractor is confirmed to have contracted a case of the target pandemic illness. Action at Stage Level 4 is focused toward minimizing the potential for spread of the illness among refinery personnel as highlighted below:

- Minimizing opportunities for transmission of the illness among refinery personnel.

DOCUMENT NO:	HSE-EAP-018	PAGE:	7 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

- Personnel are to actively monitor employee communications mechanisms (www.hrohome.com, the refinery Info Line 713-321-5775), which will be updated daily.
- Employees who have had the pandemic illness should not return to work for 24 hours after they have been free of a fever without the use of fever reducing medications. Return to work approval will be made by the Medical Department in consultation with the RLT and Health & Safety Management.

LBI Stage Level 5

LBI Stage Level 5 is initiated as absences at the refinery approach or exceeds critical levels. Level 5 is considered a crisis. Activity at Level 5 is focused on maintaining maximum refinery production with the personnel that are available, communicating with appropriate corporate executives, and if necessary, safely shutting down the refinery.

Inter-Pandemic and Post-Pandemic Phases

Pandemic situations are often characterized by waves of periods with significant illness impact followed by periods with less impact. Appropriate preparedness and response activities should continue through the lull periods. The expectation of an oncoming wave should be maintained until it is known that local impact of the illness has passed.

The Inter-Pandemic phase should be utilized to re-evaluate plans and make adjustments if necessary. Re-assessment of defined minimum staffing levels, essential personnel and critical roles necessary to maintain refinery operations, as well as illness prevention measures and supplies should occur during this time period.

The Post-Pandemic Phase begins when it is clear that the pandemic threat has passed. Re-stocking of consumable material shall be undertaken as quickly as resources allow. As with other crisis situations, a formal evaluation of the plan's adequacy and the organization's performance against the plan should be conducted.

EMPLOYEE COMMUNICATIONS

By their very nature, pandemic situations are largely unpredictable. As a result, they can cause significant apprehension among human populations. Proactive and forthright employee communications serve a vital purpose in creating an environment in which personnel feel informed and therefore will support the aspects of this plan. The following suggestions pertain to communicating pandemic related information to employees:

Types of Information to Communicate

Depending on the specific illness, severity, and transmission rate, the following types of information should be considered for communicating to refinery personnel:

- General update information on the developing situation

DOCUMENT NO:	HSE-EAP-018	PAGE:	8 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

- General information on the specific pandemic illness to include a description of the signs & symptoms
- Basic personal hygiene, protection and infection control measures to include information on effective hand washing and social distancing measures
- Seasonal flu vaccination promotions
- Measures being taken to reduce the potential for spread of the illness
- Communicate to ERT on management of potentially infected personnel
- What to do if you begin to feel ill
- Stay at home if experiencing symptoms of the illness. Do not return until 24 hours after being fever-free
- Self care & family care information
- Expectations for checking in / monitoring refinery communication mechanisms should an employee become ill or need to miss work
- Return to work requirements if an employee misses work due to the illness

Communication Mechanisms

In the initial and developing stages of the pandemic situation, training information and employee communication will typically be via email and the intranet. Face to face employee meetings can also be utilized and are useful for providing employees the opportunity to voice concerns and ask questions.

As a pandemic situation begins to impact the refinery, the communication mechanisms listed above will be supplemented by existing crisis communications systems.

The Refinery INFO Line (713) 321-5775 will be utilized to provide outgoing information to personnel in regard to the current situation and direction for returning to work if they have been impacted by the pandemic illness.

www.hrohome.com will be implemented as absence levels increase and the situation begins to become critical. hrohome.com is a two way system that in addition to outgoing information, allows employees to leave information regarding their status and availability.

TRAINING

Corporate health will develop a pandemic awareness training package. All members of the Facility Pandemic Response Team, key departmental representatives and others critical to managing the pandemic situation are required to participate in this training.

As the situation develops and local conditions require, the Facility Pandemic Response Team will develop and coordinate delivery of employee training and communications to include information on the particular illness and individual responsibilities for managing the situation at the refinery.

DOCUMENT NO:	HSE-EAP-018	PAGE:	9 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Appendix 1: Pandemic Preparedness Checklist

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
Up to WHO 3	LBI Pandemic Preparedness Phase			
	Designate Facility Pandemic Focal Point	HSSE manager		
	Establish Link with Corporate HSE / Regional Pandemic Focal Point	Facility Pandemic Focal Point		
	Monitor sources of information for the potential of emerging health threats (Local & Federal Health Agencies, Media)	HSSE		
	Review and validate Pandemic Preparedness and Response Plan	Departmental Representatives		
	Validate minimum staffing levels necessary to run refinery	Departmental Representatives		
	Prepare employee communications	HR		
	Pandemic Information Intranet Page	HR		
	Information on signs & symptoms of specific illness	HR Medical		
	General information on infectious control measures	HR Medical		
	Self / family care information	HR Medical		
	Communicate to employees as the situation requires	HR		
	Engage IS for increased telecommuting possibility	Facility Pandemic Focal Point		

DOCUMENT NO:	HSE-EAP-018	PAGE:	10 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
	Ensure adequate stockpiles of soap, paper towels, surface disinfectants and hand disinfectants are adequate	Health & Safety Purchasing		
	Ensure stock of disposable filtering facepiece respirators (N95/FFP) are adequate. Consider 2 per shift per # employees utilizing for 4 weeks.	Health & Safety Purchasing		
	Plan for illness specific absence monitoring	HR		
LBI Stage Level 0	WHO move to Global Pandemic Phase 4			
	Convene initial meeting of the Facility Pandemic Response Team	Facility Pandemic Focal Point		
	Monitor sources of information to determine extent of threat	Facility Pandemic Focal Point		
	Activate internal communications as necessitated by the situation	Facility Pandemic Response Team HR		
	Establish communications link with key outside entities such as suppliers, customers, contractors, etc.	Facility Pandemic Response Team Departmental Representatives		
	Determine Refinery Access Points and Gates that will be closed should the situation continue to develop and begin to impact the immediate area	Facility Pandemic Response Team Security		

DOCUMENT NO:	HSE-EAP-018	PAGE:	11 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
	Final check and validation of the refinery specific pandemic response plan, minimum staffing levels (Attachment 2), essential business roles, essential personnel outside of operations, work that can be performed via telecommuting versus that which must be performed on-site, current business continuity concerns, etc.	Facility Pandemic Response Team Departmental Reps		
LBI Stage Level 1 - 2 - 3	Increased spread of the target pandemic illness throughout the Americas Region, widespread outbreaks in the US, significant case spread confirmed locally			
	Assess the local situation and plan increased Facility Pandemic Response Team meeting frequency as the situation necessitates	Facility Pandemic Focal Point		
	Continue employee communications as appropriate. Intensify communication at higher levels or for aggressively advancing situations	Facility Pandemic Response Team HR		
	Determine if and what type of personnel screening is necessary based on development of the situation and the specific target pandemic illness	Facilities Pandemic Response Team		
	Require personnel to stay at home if they begin to suffer from signs / symptoms of the target illness. Employees should not return to work until they are fever free for at least 24 hours without the use of fever reducing medications.	Facility Pandemic Response Team HR		

DOCUMENT NO:	HSE-EAP-018	PAGE:	12 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
	Make disposable filtering facepieces available to employees upon request. Encourage use at higher levels. Employee that choose to voluntarily utilize a disposable filtering facepiece shall be provided with Attachment 3	H&S		
	Initiate measures to send symptomatic employees / contractors home	Facility Pandemic Response Team HR		
	Communicate general infection control procedures / procedures for handling ill employees to ERT	Emergency Services		
	Cancel business travel to areas impacted by the threat illness. Consult corporate Travel and Corporate Security for guidance	Facility Pandemic Response Team Dept Management		
	Open dialogue with USW Representatives on the situation and potential actions to be taken in the event refinery impact increases	Facility Pandemic Response Team HR		
	Encourage employees to avoid public gatherings at higher levels.	Facility Pandemic Response Team HR		
	Verify capability for increased level of remote computer system access. Increase capability if necessary.	Facility Pandemic Response Team IS		
	Establish hand sanitizing stations at places of congregation at Level 3, or distribute individual sanitizer bottles.	H&S		
	Initiate pandemic specific cleaning & disinfectant services of commonly contacted surfaces at Level 3	Facilities		

DOCUMENT NO:	HSE-EAP-018	PAGE:	13 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
	Initiate limited refinery access points	Security		
	Consider only allowing business critical visitors at Level 3	Facility Pandemic Response Team Security		
	Depending on the situation development and the specific pandemic illness, implement personnel screening at Level 3	Facility Pandemic Response Team		
LBI Stage Level 4	Current confirmed case involving a refinery employee or resident contractor			
	Daily or more frequent meetings of the Facility Pandemic Response Team to actively monitor the situation and employee absences	Facility Pandemic Focal Point		
	Send non-essential employees home during local active waves of the illness - ensure they monitor communication mechanisms	Facility Pandemic Response Team Departmental Representatives		
	Activate www.hrohome.com and communicate that to employees	Facility Pandemic Response Team HR		
	Advise personnel of their responsibility to monitor www.hrohome.com and the Refinery Info Line (713-321-5775)	Facility Pandemic Response Team HR		
	Update employee communication mechanisms on a daily basis	Facility Pandemic Response Team HR		

DOCUMENT NO:	HSE-EAP-018	PAGE:	14 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
	Suspend employee vacations as necessary	HR		
	Disallow general visitors.	Facility Pandemic Response Team Security		
	Implement personnel screening determined appropriate for the specific pandemic illness	Facility Pandemic Response Team		
	Implement strict return to work screening for employees who have been closely exposed to or suffered from the threat illness.	Facility Pandemic Response Team Departmental Representatives HR Medical		
	Actively monitor employee absences in an effort to see leading indicators of levels approaching Stage Level 5	Facility Pandemic Response team Departmental Representatives HR		
	Continuously review stock of supplies such as masks, disinfectant, etc to determine adequacy and need to restock	Facility Pandemic Response Team		
	Implement social distancing measures as follows:	Facility Pandemic Response Team Departmental Representatives Facilities		
	Cancel or postpone non-essential meetings, gatherings, training, etc.			

DOCUMENT NO:	HSE-EAP-018	PAGE:	15 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
	When not possible to cancel meetings, minimize meeting times, utilize large conference rooms, and sit 3ft from one another.			
	If possible, arrange for non-essential employees to work from home.			
	Cancel unnecessary travel			
	Encourage employees to bring lunch and eat at their desk. Stagger lunchtimes for shift personnel.			
	Consider closing break rooms or other places where employees congregate.			
	Arrange for employees to telecommute or work alternative schedule where possible.			
	Encourage employees to avoid public gatherings or recreational activities wherein they might come in contact with infected persons			
	Transition to 12 hr Shift in Operations and Maintenance	Facility Pandemic Response team Departmental Representatives HR		
LBI Stage level 5	Absenteeism approaching or beyond critical levels			
	Implement Crisis Management Plan	Refinery Leadership		
	Establish communication link with Executive Team	Refinery Leadership		

DOCUMENT NO:	HSE-EAP-018	PAGE:	16 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Pandemic Preparedness Checklist				
This checklist provides guidelines for the measures that may be implemented during the threat of a pandemic illness. The measures referenced below for various stages of pandemic development may be accelerated or delayed based on local episodic conditions of the illness.				
ALERT / STAGE LEVEL	ITEMS TO CONSIDER	Dept / Responsibility	Required Action	Priority
	Notify Regional business Continuity Focal Point	Refinery Leadership		
	Continue daily or more frequent meetings of the Facility Pandemic Response Team	Facility Pandemic Focal Point		
	Assess opportunities to minimize impact by shifting qualified personnel to more critical units	Facility Pandemic Response Team		
	Maintain active contact with critical personnel who are absent to assess their return to work timeframe	Supervision		
	Plan for rate reduction, circulation or shutdown of units that do not have adequate staffing	Refinery Leadership		

DOCUMENT NO:	HSE-EAP-018	PAGE:	17 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Appendix 2: Pandemic Minimum Staffing Guidelines

Management / Leadership

- 2 RLT members on site required (days)

Operations (PSM Based):

Supervision:

- Plant Shift Superintendent - 1 days / 1 Nights (7 X 12 schedule no days off)
- Shift Supervisors – 2 days / 2 Nights (7 X 12 schedule no days off)

Crude

- Crude Console – 2 days / 2 Nights (7 X 12 schedule no days off)
- Crude LOP – 5 days / 5 Nights (7 X 12 schedule no days off)

HDS (Current as of Sept 1. Collapse in progress)

- HDS Console (Currently pre collapse)
 - LT HDS Console - 1 days / 1 Nights (7 X 12 schedule no days off)
 - HVY HDS Console - 1 days / 1 Nights (7 X 12 schedule no days off)
 - Reform Console - 1 days / 1 Nights (7 X 12 schedule no days off)
- LT HDS LOP - 4 days / 4 Nights (7 X 12 schedule no days off)
- HVY HDS LOP - 4 days / 4 Nights (7 X 12 schedule no days off)
- Reform LOP – 2 days / 2 Nights (7 X 12 schedule no days off)

FCCU

- FCCU Console – 2 days / 2 Nights (7 X 12 schedule no days off)
- FCCU LOP – 5 days / 5 Nights (7 X 12 schedule no days off)

Coker

- Coker Console – 2 days / 2 Nights (7 X 12 schedule no days off)
- 736 Coker LOP – 5 days / 5 Nights (7 X 12 schedule no days off)
 - Kinder Morgan support required
- 737 Coker LOP - 4 days / 4 Nights (7 X 12 schedule no days off)

Lubes / Utilities / Loading Rack

- Lubes/Utilities Console - 1 days / 1 Nights (7 X 12 schedule no days off)
- Lubes LOP – 2 days / 2 Nights (7 X 12 schedule no days off)
 - Stand alone process could be shutdown – large number of support folks at loading racks, Pumping and blending, and Lab that could be taken off of required list if we made this decision.
- 533 Pumping and Blending LOP – 2 days and 1 nights (2 day employees needed 5 days a week and 1 day employees on weekends – 1 night person 7X12 schedule)
 - If Lubes is shutdown – required employees could be 1 day and 1 night for fire watch only.
- Utilities LOP - 4 days / 4 Nights (7 X 12 schedule no days off)
- Loading Rack – 4 days to support Lubes business – could go to 2 if Lubes is down (with Lubes down will still need to load and unload caustic)

DOCUMENT NO:	HSE-EAP-018	PAGE:	18 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

SRC

- SRC Console – 2 days / 2 Nights (7 X 12 schedule no days off)
- SRC LOP – 5 days / 5 Nights (7 X 12 schedule no days off)

OM/Docks

- OM/Docks – 5 days / 5 Nights (7 X 12 schedule no days off)
 - At least 2 of the 5 would need to be qualified on the docks.

Lab

- “C” Lab – 2 days / 2 Nights (7 X 12 schedule no days off)
- “C” Lab Days – 2 days if Lubes continues to run
- “A” Lab – 2 days / 2 Nights (7 X 12 schedule no days off)
- 1 Staff member – manage supplies, CofA, ISO approvals

Maintenance

- Electrical/Power distribution Techs – 4
- Analyzer Techs – 2
- DCI Techs – 2
- Instrument Techs – 2
- Machinists – 4
- Ref Mechs – 4
- Special Equipment Operators – 1
- Radio Techs – 1
- Facilities – 2
- Warehouse - 1
- Maintenance Supervisors – 3

Reliability**Fixed Equipment**

- 2 Engineers
- 2 Inspectors

Machinery / Rotating Equipment

- 5 personnel (1 per asset team)

IEA

- 2 Instrument Engineers (one staff level and one asset team)
- 2 Instrument Specialists
- 1 Electrical Specialist
- 1 Electrical Engineer
- 1 Analyzer Specialist
- 1 Analyzer Engineer

DOCUMENT NO:	HSE-EAP-018	PAGE:	19 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Ref Tech

Information pending as of 09/25/09

HSSE

Health & Safety

- No staff necessary at the refinery. At least 1 need be available for consultation

Environmental

- No staff necessary at the refinery. At least one need be available for consultation.

Emergency Services / ERT

- 1 ES Staff
- 1 Shift Commander
- 9 ERT Members (4 rescue, 3 marine spill)

Security

- 1 Supervisor
- 1 Dispatcher
- 1 Patrol Officer
- 12 Contract Security (8 days / 4 nights)

IS

Information pending as of 09/25/09

Contractors

AEI

- 2 Shift Clerks

Austin

- 5 Boilermakers
- Pipefitters
- 4 Welders
- 4 General Laborers
- 2 HEO (Fuel Truck and Tractor Trailer Driver)
- 3 SRU Conops
- 3 Plant Conops (Environmental)
- 1 Firewater Crew
- 4 Janitorial
- 3 Facilities
- 3 Coker hydraulics
- 1 Supervisor (BM, PF, Weld, MW, HEO)
- 1 Supervisor (Conops, Facilities, Coker Hyd)

DOCUMENT NO:	HSE-EAP-018	PAGE:	20 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

- 1 Safety
- 1 Mail

Veolia

- 1 Supervisor
- 8 Hydroblast / Vacuum Techs

Coopwoods

- 1 Supervisor
- 2 HVAC Craft people

Pro-Inspect

- 2 API Inspectors

Con-Am

- 4 UT, PT, X-Ray

Brock

- 3 Supervisors
- 12 Scaffold Builders
- 4 Insulators
- 4 Asbestos Abators

Betz

- 3 Chemical Treatment Support

Caleb Bret / Intertek

- 4 Inspection & Sampling

Encompass

- 8 Fugitive Emissions/leak repair

cSoft

- 1

Process Solutions

- 3 Environmental

Crane Pro

- 2 737 Crane

DOCUMENT NO:	HSE-EAP-018	PAGE:	21 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

Appendix 3

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

Respiratory Protection Awareness Training
Voluntary Use of Disposable Dust Masks

Who is this information for?

This handout must be reviewed by anyone who uses a single-use filtering facepiece (i.e. disposable dust mask) on a voluntary basis.

Misuse can be hazardous

If a respirator is used improperly or not kept clean and disinfected, the mask itself can become a hazard to you.

DOCUMENT NO:	HSE-EAP-018	PAGE:	22 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

If Houston Refinery provides masks for your voluntary use, or if you utilize your own mask/respirator, you must take the following precautions to be sure that the mask itself does not present a hazard.

Precautions you must take before use

The following must be assured:

Disposable dust masks may only be worn at the request of employees if the facility determines that the masks will not by themselves create a hazard.

The mask selected is certified for use against the contaminant. A label or statement of certification should appear on the respirator packaging.

Particulate dust masks may not be worn in areas where contaminant concentrations may exceed recommended or government mandated exposure limits or in oxygen deficient atmospheres.

For example, a respirator designed to filter dust particles will not protect you against gases, vapors or very small solids particles of fumes or smoke.

Individuals who choose to wear dust masks are NOT cleared to use half face or full face air-purifying respirators (APR) or perform any job requiring the use of these respirators without being included in the facility's respiratory protection program.

No medical clearance is required for disposable dust mask users.

No fit testing is required for disposable dust mask users.

Precautions you must take during use:

Follow all instructions provided by the Respiratory Program Coordinator.

Follow the manufacturer's instructions provided with the mask (usually in the packaging) regarding use, maintenance, care, cleaning/disposal, storage and limitations.

Fitting Instructions: These must be followed each time the mask is worn.

Cup the mask in your hand, with the nosepiece at your fingertips, allowing the headbands to hang freely below your hand.

Position the mask under your chin with the nosepiece up. Pull the top strap over your head resting it high at the top back of your head. Pull the bottom strap over your head and position it around the neck below the ears.

Place your fingertips from both hands at the top of the metal nosepiece. Using two hands mold the nose area to the shape of your nose by pushing inward while moving your fingertips down both sides of the nosepiece.

Pinching the nosepiece using one hand may result in improper fit and less effective mask performance. Use two hands.

DOCUMENT NO:	HSE-EAP-018	PAGE:	23 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

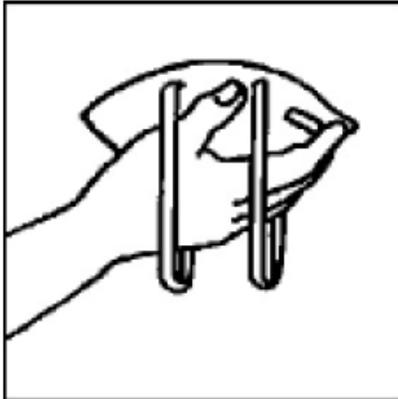


Fig. 1



Fig. 2



Fig. 3



Fig. 4

DOCUMENT NO:	HSE-EAP-018	PAGE:	24 OF 24
DOCUMENT NAME:			
PANDEMIC PREPAREDNESS AND RESPONSE GUIDELINE			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

Houston Refining LP	DOCUMENT: HSE-ENV-610 Page: 1 of 4		
MANUAL: Environmental Department SOP Manual	REVISION NUMBER: 4	REVISION DATE: 06-10-13	
DOCUMENT TITLE: On-Site Waste Activities	EFFECTIVE DATE: September 12, 2002	EXPIRATION DATE: None	
WRITTEN/REVISED BY: Mike Godfrey, Principal Engineer	REVIEW FREQUENCY: 5-Years		
APPROVER NAME/TITLE: Roel Munoz, Environmental/DOT Supt.	SIGNATURE:	DATE:	

1.0 SUMMARY

The purpose of this procedure is to provide guidelines for waste handling and on-site disposition of waste generated at Houston Refining LP (HRO).

The procedure will define the roles of the Environmental Department, the Solid Waste Coordinator, Operations, Maintenance, and other affected groups.

2.0 SCOPE

This procedure applies to all Operations, Maintenance, Laboratory, and construction areas generating waste materials, including any hydrocarbon spills.

3.0 SUMMARY OF ROLES AND RESPONSIBILITIES and DEFINITIONS

3.1 Operations, Maintenance, Laboratory, and Construction personnel are responsible for notifying the Solid Waste Coordinator (SWC) at least ten (10) days prior to waste generation from activities such as unit or tank cleanouts, construction work, building renovations, and/or maintenance and turnaround activities.

3.2 The Solid Waste Coordinator is responsible for assisting Operations, Maintenance, and Construction personnel in properly containerizing and storing of waste material, including spilled hydrocarbons or spills of hazardous material. The SWC is responsible for ordering the proper containers and having them placed at the appropriate site for the job. The SWC will collect samples of the waste material for analytical testing, submit them to an approved laboratory, following the proper chain of custody, for waste characterization, and will evaluate the results and assign waste code numbers. The SWC will schedule the movement of solid wastes to storage and to final disposition, and the SWC will determine the land treatment plot that will be used for on-site waste disposition (non-hazardous waste only).

3.3 The Environmental Department is responsible for remaining current on all federal and state regulatory requirements, and for providing regulatory and technical guidance to the plant personnel, including the SWC.

3.4 DEFINITIONS

Unit Staging Area: A unit staging area is a designated place for temporary storage of waste on the unit. The unit staging areas should be clearly marked and a sign placed there to identify it as such. A unit may contact the SWC to establish a unit staging area.

DOCUMENT NO.	HSE-ENV-610	REVISION NO.	4
REVISION DATE:	06/10/13	PAGE:	2 OF 4

Plant Trash: Plant Trash consists of pallets, cardboard, office waste, empty bags, wire/metal bands, and food waste.

Oily Wastes: Oily Trash may consist of anything that is contaminated with hydrocarbons. Examples of oily trash are all process filters, oily personal protective equipment (slickers, gloves), oily rags, and floor dry that has been used to clean up a spill.

Land-farms: Facility units for the treatment and/or disposal of industrial solid waste subject to permit limitations defined by the Texas Commission on Environmental Quality (TCEQ). Land farms are fixed biological treatment areas that break down organics into carbon dioxide and water. In the past, HRO has been authorized to operate both hazardous and non-hazardous land treatment units (land-farms) to manage only wastes generated on-site. However, HRO no longer operates "active" hazardous waste land-farms; hazardous waste can no longer be placed on these sites.

4.0 PROCEDURES

4.1 Operations and Maintenance shall:

- 4.1.1 Notify the SWC at least ten (10) days prior to the onset of any scheduled activity that will generate a waste. This will ensure appropriate time to secure containers, obtain samples of the waste stream, and determine strategy for storage of the waste material, as necessary. For spills of hydrocarbons or hazardous materials, the SWC shall be contacted immediately, either by radio, telephone, or by pager so that he/she can respond quickly with appropriate equipment to clean up the spill, sample, and dispose of the spilled material according to all regulatory requirements.
- 4.1.2 Identify any empty drums or drums containing waste material and place these in the staging area on the unit. Plant trash should not be placed in the unit staging area. Empty drums are picked up from each unit twice weekly (Tuesday and Thursday). In order to be placed on the schedule for drum pick-up, units must contact the SWC and request drum pickup. All pickups for waste material (except plant trash or oily trash) must be arranged with the SWC.
- 4.1.3 Unit personnel are responsible for segregating plant trash from oily trash. Each unit has been provided with small HRO dumpsters designated for plant trash. Plant trash roll-off boxes are located at the plant trash ramp adjacent to Marine Vapor Combustor Unit. Transportation is responsible for emptying each unit's plant trash dumpster into the trash boxes at the plant trash ramp.

DOCUMENT NO.	HSE-ENV-610	REVISION NO.	4
REVISION DATE:	06/10/13	PAGE:	3 OF 4

- 4.1.4** Each unit should have a designated receptacle for oily trash. Transportation can provide separate dumpsters for each unit or maintenance area. If smaller receptacles for oily trash are needed, the SWC can provide these. These should be clearly labeled for oily trash. Oily trash should not be placed into the plant trash dumpster. The oily trash and process filters are taken to a separate roll-off box at the plant trash ramp (30 yd. container designated by signs) by the HRO transportation department. Drums or small receptacles for oily trash are emptied by the Waste Operations Crew and returned weekly.
- 4.1.5** Any waste that is placed into the pickup area or called in must be properly labeled or identified on the container. Examples: "Waste Lube Oil", "Charcoal from HVAC System", "Paint Waste". Hazardous wastes will be given priority.

5.2 The Solid Waste Coordinator shall:

- 5.2.1** Assist each unit in establishing a temporary unit staging area.
- 5.2.2** Schedule each unit for pick-up of empty drums/containers and waste material from the designated unit staging area.
- 5.2.3** Assist Operations personnel with clean-up of hydrocarbon spills by providing equipment and personnel to clean up, package, sample, and dispose of the spilled material in compliance with all applicable regulations. The SWC shall utilize qualified contractor personnel as necessary to achieve removal and disposal of the spilled material as quickly as possible. If possible, recovered hydrocarbons shall be recycled through the refinery's slop oil system.
- 5.2.4** Drums and containers shall be inspected and their integrity assured prior to being moved.
- 5.2.5** Prior to storage of waste at East or West Staging, all containers are labeled with a completed hazardous or non-hazardous label (with accumulation dates). Unlabeled containers or containers whose contents are unknown are to be labeled as hazardous until the contents are positively identified and labeled. Drums or roll-off bins containing hazardous and non-hazardous waste will be transported and stored at East or West Staging by the Waste Operations crew.
- 5.2.6** Maintain a waste tracking database containing current inventories of East and West Staging areas. Ensure that hazardous waste is not stored at HRO for more than 90 days.
- 5.2.7** Direct the Waste Operations crew in obtaining and preserving samples for waste stream characterization and proper disposal or recycling.

DOCUMENT NO.	HSE-ENV-610	REVISION NO.	4
REVISION DATE:	06/10/13	PAGE:	4 OF 4

- 5.2.8 Following review of the analytical data, schedule the pickup of the waste stream from the East or West Staging.
- 5.2.9 Coordinate all waste movements (on-site and off-site via manifests) with Data Management Department personnel to ensure an accurate account of the waste stream, number and type of drums, and quantity of material being shipped.
- 5.2.10 Manage staging areas so that these meet safety and regulatory requirements.

5.3 The Environmental Department shall:

- 5.3.1 Assist the SWC as needed in submitting samples to an approved laboratory for waste analysis for characterization and loading.
- 5.3.2 Assist the SWC in reviewing analytical results, verifying the validity of results, and in assigning the appropriate waste code number.
- 5.3.3 Data Management personnel shall maintain a waste database, and prepare internal and external waste manifests as needed.

6.0 CHEMICALS INVOLVED, MSDS NUMBERS, REPORTABLE QUANTITY

Waste material encompasses a variety of compounds and chemicals. Material Safety Data Sheets are referenced to determine specific chemicals that may be in the waste material. Analytical evaluation along with process knowledge of the material and of the process generating the waste material is gathered to characterize each waste stream.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The Supervisor of personnel involved in the waste handling operation will determine the proper personal protection required using information from the MSDS, analytical results, and area monitoring. For specific chemical guidance, see attached chart "Chemical Agent Identification and PPE Determination". Call Industrial Hygiene if you have any questions about proper personal protective equipment to be used for a job.

8.0 WASTE MINIMIZATION ACTIONS

Each unit/area should ensure that activities and practices are in place to prevent or reduce the generation of waste materials. Activities such as source reduction and reuse/recycling of waste through operating procedure changes can greatly reduce the quantity of waste generated at HRO. Avoid mixing contaminated material with clean or uncontaminated material or soil. Do not mix hazardous waste with non-hazardous waste because this severely limits disposal options and increases disposal costs.

(b) (7)(F), (b) (3)

(b) (7)(F), (b) (3)

FIGURE 2-1
**REFINERY LOCATION
AND AREA TOPOGRAPHY**

DATE: 10/24/94 SCALE: 1" = 2000'



LYONDELL-CITGO
Refining Company Ltd.
HOUSTON, TEXAS

QPS Engineers, Inc.

MAILING ADDRESS:

U.S. Department
of Transportation

United States
Coast Guard



Captain of the Port
U.S. Coast Guard

P.O. Box 446
Galena Park, TX 77547
(713) 671-5100

16601

JAN 09 1992

Lyondell Petrochemical Company
Attn: Mr. Deborah W. Kryak
Box 2451
Houston, TX 77252-2451

Subj: Your Request for Alternative Compliance with Title 33 CFR 156.170(c)(4)

Re: Your letter dated December 12, 1991

Dear Sir:

I have reviewed your request for an alternative compliance from Title 33 Code of Federal Regulations (CFR) Section 156.170(c)(4), regarding the annual pressure test of transfer pipe systems.

During my tour of your facility I noted the primary containment and the topography of the secondary facility containment which would drain any oil spills upland of the dock area into a catchment system. I find your overall facility containment system provides an equivalent level of safety and protection from pollution by oil or hazardous materials. Consequently, I am granting your request to require that your pipe systems only be tested back to the first valve on shore. A copy of this letter will be maintained in your facility file for future reference.

This practice is considered an acceptable alternative in accordance with Title 33 CFR 154.107. Should this procedure change you must notify me. If you have any questions, please feel free to contact Lieutenant Junior Grade Clapper of my staff at the above number.

Sincerely,

R. J. Prosser
Commander, U.S. Coast Guard
Chief, Port Operations Department
By direction of the Captain of the Port

U.S. Department
of Transportation

United States
Coast Guard



Commanding Officer
National Strike Force
Coordination Center

1461 US Hwy 17 North
Elizabeth City, NC 27909
Staff Symbol: (ops)
Phone: (919) 331-6029

16471/1
93-011/2

Mr. Edward K. Roe
Clean Channel Assoc.
P.O. Box 2489
Houston, TX 77252-2489

Dear Mr. Roe:

I have completed a review of your organization's resources and records for the purpose of determining your classification level as an Oil Spill Removal Organization. This review included a visit to your response resource sites and was conducted as outlined in Coast Guard Navigation and Vessel Inspection Circular 12-92 (NVIC 12-92) and NSFCC Instruction 16480.1 dated June 1993. The review has resulted in the following determination:

FINAL CLASSIFICATION for the following environments:

CLASS E - River & Canal Environment
CLASS E - Inland & Nearshore Environment

You have been assigned OSRO Classification Number 011. Enclosure (1) to this letter provides a summary of the response resources available at each of your sites. You must provide this letter and list to any client wishing to name you as their OSRO for the purposes of vessel and facility response plans. This list will help them determine if you can provide sufficient resources to the required location(s) within the response times necessary for their response plans. This list will also be provided to all Coast Guard response plan reviewers, who will check it against the response plans that have been submitted to them for approval.

If you have questions regarding your final classification or information in the attached sheets, please contact CDR Dave Giraitis of my staff at (919) 331-6005.

Sincerely,

D. S. JENSEN
Captain, U.S. Coast Guard
Commanding Officer

Encl: (1) Final Classification Resource Summary Printout

Copy: COMDT(G-MEP)
Gulf Strike Team

CLEANCHANNELASSOC

ID:713-676-2571

DEC 12 '96 15:10 No.004 P.02

U.S. Department
of TransportationUnited States
Coast GuardCommanding Officer
National Strike Force
Coordination Center1461 US Hwy 17 North
Elizabeth City, NC 27809
Staff Symbol: (ops)
Phone: (919) 331-600016471/1
96-011

JUL 22 1996

Mr. Edward K. Roe
Clean Channel Association
111 East Loop North
Houston, TX 77029

Dear Mr. Roe:

Your application for classification as an Oil Spill Removal Organization (OSRO) has been reviewed and processed as outlined in the Coast Guard OSRO Classification Guidelines dated 28 December 1995.

Enclosures (1) and (2) to this letter provide a summary of your interim classifications by environment and COTP zone, and a summary of the resource totals for Temporary Storage Capacity (TSC), Effective Daily Recovery Capacity (EDRC) and boom used to determine these classifications. A copy of this letter with enclosures (1) and (2) should be provided to your current and potential clients. A complete listing of all of your resources can be downloaded from the RRI Bulletin Board System at (919) 331-6039/6042 or, if you prefer, we can mail a printout to you upon request.

You will be contacted in the near future to schedule a resource verification visit. Final classification will be issued following completion of resource verification. If you have any questions regarding your classification, please contact LTJG George Ganoung of my staff at (919) 331-6000, ext 3041.

Sincerely,

D. B. PASCOE
Captain, U. S. Coast Guard
Commanding OfficerEncl: (1) OSRO Classification Information
(2) Classifications by COTP ZoneCopy: COMDT (G-MOR)
ISC New Orleans (m)
MSO Galveston
MSO Houston
MSO Port Arthur
Gulf Strike Team



Texas General Land Office
Garry Mauro, Commissioner

Stephen F. Austin Building
1700 North Congress Avenue
Austin, Texas 78701-1495
(512) 463-5001

Timothy G. McKinna
Deputy Land Commissioner
Oil Spill Prevention
& Response
(512) 463-5195
Fax (512) 475-1560

July 29, 1992

Mr. Edward Roe
Clean Channel Association
P. O. Box 2489
Houston, Texas 77252-2489

Re: Issuance of Discharge Cleanup Organization Certificate,
DCO-504

Dear Mr. Roe:

Congratulations! You have been certified by the Texas General Land Office as a Discharge Cleanup Organization. This certification allows you to be listed as a clean up contractor by facilities in their facility response plan. Additionally, this allows the General Land Office to utilize your services in a state funded spill response.

During the review process we noted items in your application that need clarification. These items and a specific explanation statement will follow under separate cover.

As stated in the regulations, the maintenance of this certificate will require an annual review of each DCO. During this inspection, spill response documentation from the preceeding months will be reviewed along with new items that can improve spill response and coordination. Your organization is encouraged to maintain the highest response standards possible and to view your response duties as an opportunity to minimize environmental impact, as well as operate a profitable business.

The certification process is not a static situation. As in all emergency response operations, continued refinement of operations will be necessary through increased training and in some cases equipment purchase. The implementation of federal oil pollution standards is progressing forward and these standards could well change the nature of spill response and preparedness. Please stay tuned to the processes.

Thank you for your information submitted with the application packet. Additionally, I would like to thank you for the cordial atmosphere you created for my inspection staff.

Sincerely,

Timothy G. McKinna
Timothy G. McKinna, Deputy Commissioner
Oil Spill Prevention and Response

TEXAS



GENERAL LAND OFFICE

JERRY PATTERSON, COMMISSIONER

February 21, 2012

Clean Channel Association, Inc.
Mr. Phil Glen
3110 Pasadena Freeway
Pasadena, TX 77503

RE: Discharge Cleanup Organization (DCO) Certification

Dear Mr. Glen:

Enclosed is your updated DCO certificate. It is valid for three years from the date shown as long as your company continues to meet minimum certification requirements. Those requirements include, among other things, notifying the General Land Office of any change of ownership or of any major change in equipment or personnel.

We thank you for your participation in this important program and look forward to working with you in the future.

Sincerely,

Robert L. Rivera
DCO Program Administrator

Enclosure: (3 Copies)

Stephen F. Austin Building • 1700 North Congress Avenue • Austin, Texas 78701-1495

Post Office Box 12873 • Austin, Texas 78711-2873

512-463-5001 • 800-998-4GLO

www.glo.state.tx.us

Date: February 21, 2012

DCO # 504



Discharge Cleanup Organization Certificate

Clean Channel Association

Pasadena, Texas

This certificate carries with it the need to maintain a high level of response preparedness, to respond in a timely, professional manner, and to notify the Texas General Land Office of any change in the Holder's ability to accomplish this mission. Certification is for three years from the above date.

Jerry Salton
 Commissioner
 Texas General Land Office

Gregg Felton
 Deputy Commissioner
 Texas General Land Office

Date: October 1, 2009

DCO # 509



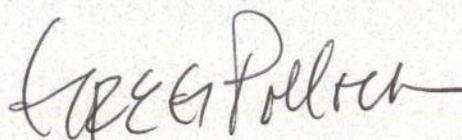
Discharge Cleanup Organization Certificate

Garner Environmental Services

Deer Park, Texas

This certificate carries with it the need to maintain a high level of response preparedness, to respond in a timely, professional manner, and to notify the Texas General Land Office of any change in the Holder's ability to accomplish this mission. Certification is for three years from the above date.


Commissioner
Texas General Land Office


Deputy Commissioner
Oil Spill Prevention and Response



GARNER ENVIRONMENTAL SERVICES, INC.

CORPORATE OFFICE: 1717 W. 13TH STREET, DEER PARK, TX 77536 • 281-930-1200 • 800-424-1716

Garner Environmental Services - OSRO Number: 27

COTP Zone:	Operating Environment	Facility MMPD	Facility WCD1	Facility WCD2	Facility WCD3	Vessel MMPD	Vessel WCD1	Vessel WCD2	Vessel WCD3
Corpus Christi - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corpus Christi - DISTRICT 8	Inland	Yes	~	Yes	Yes	Yes	Yes	Yes	Yes
Houston - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Houston - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lower Mississippi - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lower Mississippi - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile(Panama City, FL) - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile(Panama City, FL) - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Morgan City - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

BRANCH OFFICES

DEER PARK, TX
(OPERATION & TRAINING)
281-930-1200

• PORT ARTHUR, TX
(OPERATIONS)
409-983-5646

• PORT ARTHUR, TX
(TRAINING)
409-984-9836

• LA MARQUE, TX
(OPERATIONS)
409-935-0308



GARNER ENVIRONMENTAL SERVICES, INC.

CORPORATE OFFICE: 1717 W. 13TH STREET, DEER PARK, TX 77536 • 281-930-1200 • 800-424-1716

Morgan City - DISTRICT 8	Inland	Yes							
New Orleans - DISTRICT 8	River or Canal	Yes							
New Orleans - DISTRICT 8	Inland	Yes							
Port Arthur - DISTRICT 8	River or Canal	Yes							
Port Arthur - DISTRICT 8	Inland	Yes							

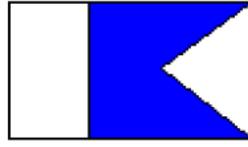
BRANCH OFFICES

DEER PARK, TX
(OPERATION & TRAINING)
281-930-1200

• PORT ARTHUR, TX
(OPERATIONS)
409-983-5646

• PORT ARTHUR, TX
(TRAINING)
409-984-9836

• LA MARQUE, TX
(OPERATIONS)
409-935-0308



CLEAN CHANNEL ASSOCIATION



Clean Channel Association Resource Manual 2012

2012

**CLEAN CHANNEL ASSOCIATION, INC.
MEMBERS RESOURCE MANUAL**

TABLE OF CONTENTS

Section	Page
1. Call out Procedures	4
2. Responsibilities.....	5
3. Member Companies, Contacts and Directions	6
4. Resources.....	19
CLEAN CHANNEL/Members Equipment	21-26
Additional Resources	27-32
5. Key Phone Numbers.....	33

January 2012

Letter of Promulgation

This page promulgates the Clean Channel Association Resource Manual. The purpose of the manual is to provide operating personnel with the information they will need to initiate a Clean Channel Association (CCA) response to a spill. The manual is condensed from the previous Response Plan. It is predicated on the fact that the spiller is responsible for directing all activities associated with the spill. If the spiller is unknown or takes inadequate action, the government, through the U. S. Coast Guard or Texas General Land Office, assumes that role. CCA does not manage a spill but provides resources (and technical advice) to the spiller. CCA provides on-water containment and removal equipment. CCA will generally limit deployment activities to medium or major spills, i.e. 10,000 gallons or more. However, if the spiller needs technical support for any size spill or potential spill, always call CCA.

S. P. Glenn

1. CALL OUT PROCEDURES

- A. The activation of a CCA response is accomplished by contacting the administrative director or any CCA employees. Contact can be accomplished by telephoning as follows:

Administrative Director: Phil Glenn

CCA Office: 713-534-6195
 Fax: 713-534-6197
 Home: (b) (6)
 Cellular phone: (b) (6)
 Email: phil@cleanchannel.org

Equipment and Maintenance Supervisor: Steven Bigby

Home: (b) (6)
 Cellular phone: (b) (6)
 Email: steven@cleanchannel.org

Administrative Assistant: Karen Storm

Cellular phone: (b) (6)
 Email: karen@cleanchannel.org

Training Specialist: William (Bill) T. Hand

Cellular phone: (b) (6)
 Email: bhand47@yahoo.com

- B. If unable to contact CCA staff, T&T Marine Salvage (CCA's equipment managers/operators) can be contacted directly to activate CCA resources. T&T's 24 hr. number is 281-488-5757.

T&T Marine Salvage: Ronnie Rouse
 Cellular phone: (b) (6)
 Email: ronnier@tandtmarine.com

- C. **In extraordinary emergency situations (such as hurricane evacuation) if the above numbers are not working, please call 281-513-7172. This phone will not be available during normal operations.**

- B. When contact is made, the following information should be provided to CCA:
- Name and contact number of person calling, date, time, telephone number of responsible party's contact person
 - Spiller
 - Source of spill (vessel name, pipeline, etc.)
 - Material spilled, including any hazards involved (provide copy of MSDS)
 - Quantity spilled
 - Location of spill
 - Confirmation that USCG and GLO have been notified
 - Assistance requested of CCA to be activated immediately
 - If immediate assistance is not requested what resources are desired to be alerted and put on standby
 - Locations that assistance is required (potential staging areas are listed in Appendix 2)
 - Name of spiller's representative at each location
- C. Upon receipt of the above information, CCA will ensure that CCA can safely respond. The assistance requested will then be compared with CCA's resource listing to identify the resources most nearly meeting the spiller's request. Once identified, the contractor or member able to provide the resources will be contacted by CCA, provided the above information, and requested to respond. Once a commitment to respond has been obtained, the spiller will be notified of specific resources, including personnel, responding, and the location(s) they are responding to. Upon activation of CCA's Response Network and after initial responders have been requested all other members will be notified. Members will be requested to prepare their equipment for deployment and standby for further guidance.
- D. Efforts should be made to place the responding resource in contact with the spiller's representative as soon as possible. The earlier they are in contact, the more coordinated the effort will be.

2. MEMBER COMPANIES, CONTACTS AND DIRECTIONS**BP PIPELINES N.A.**

3811 1/2
 F. M. 646 North
 Santa Fe, Texas 77510

REPRESENTATIVE: Gordon White
 Phone: 409-925-1161
 Cell: (b) (6)
 Home: [REDACTED]
 Email: Gordon.white@bp.com

DOW CHEMICAL COMPANY

2301 N. Brazosport Blvd., Bldg. B-1210
 Freeport, TX 77541-3257

REPRESENTATIVE: Donnie Shoemaker

 Phone: 979-238-5771
 Cell: (b) (6)
 Fax: 979-238-0117
 Email: dshoemaker@dow.com
 24 hr: 979-238-2112

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

24 Hr. Emergency Dispatch 979-238-2112
 Fax: 979-238-2034

Billy Yates 979-238-2048
 Wayne Harris 979-238-5564
 Chandler Westjohn 979-238-7951
 Jim Lipscomb 979-238-2853
 Larry Davis 979-238-5833
 Dewey Lemon 979-238-4503

(b) (6)

ENERGY TRANSFER PARTNERS

P. O. Box 250
 Mont Belvieu, TX 77580

REPRESENTATIVE: Rusti Beckmann

Phone: 281-385-3620
 Fax: 281-385-3609
 Cell: (b) (6)
 Home: [REDACTED]

Email: rusti.beckmann@energytransfer.com

ALTERNATE: Murray Cato

Phone: 281-385-3575
 Cell: (b) (6)
 Fax: 281-385-3609
 Email: murray.cato@energytransfer.com

ENTERPRISE PRODUCTS

801 Dock Road PO Box 551
 Texas City TX 77590 Texas City TX 77592

REPRESENTATIVE: Gregory DeLong
 Phone: 409-949-3706
 Email: gndelong@eprod.com
 Cell: (b) (6)
 Fax: 713-803-4631

ALTERNATE: Marcella Densman
 Phone: 281-424-6818
 Cell: (b) (6)
 email: mmdensman@eprod.com

ALTERNATE: Chris Pipkin
 Phone: 281-424-6802
 Email: capipkin@eprod.com
 Cell: (b) (6)
 24 hr.: 1-800-530-1050
 Home: (b) (6)

OTHERS AUTHORIZED TO RELEASE EQUIPMENT:

Freeport: Jimmy Nealy
 Phone: 979-237-6751
 Email: jinealy@eprod.com
 Cell: (b) (6)
 Home: [REDACTED]
 Fax: 979-237-6782

Freeport Alt. John Hazley
 Phone: 979-237-6756
 Email: jghazley@eprod.com
 Cell: (b) (6)

Texas City: Terry Hutson
 Phone: 713-393-1105

Email: tlhutson@eprod.com
 Cell: (b) (6)
 Home: [REDACTED]
 Fax: 409-949-3732

Kent Geiman, Regional Director, Crude Operations
 Phone: 713-381-6807
 Email: kgeiman@eprod.com
 Cell: (b) (6)
 24 hr.: 1-800-530-1050
 Home: (b) (6)
 Fax: 713-803-1358

DIRECTIONS: Enterprise's offices are located in Baytown at the intersection of Baker Road and Decker Drive (Loop 330) on the southwest corner immediately north of the Enterprise Baytown Terminal. Take I-10 East toward Baytown. Take the Loop 330 exit from I-10. Take the Baker Road exit from Decker Drive. Turn right at Baker Road and the office will be on your left.

ExxonMobil Pipeline Company

Billing Address
 301-A Old Choate Road
 Houston, TX 77034

Mailing Address (Hdq.):

800 Bell Street
 PL-EMB-603G
 Houston, TX 77002

REPRESENTATIVE: John Dunn (Room EMB 603G)

Phone: 713-656-3666
 Fax: 713-656-8232
 Pager: N/A
 Cell: (b) (6)
 Email: john.w.dunn@exxonmobil.com

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

Geoff Craft Phone: 713-656-2227
 Cell: (b) (6)
 Other: 832-360-7441

Matt Young Phone: 281-925-3856
 Cell: (b) (6)
 Pager: N/A
 Home: (b) (6)

Frank Box: Phone: 713-475-0106
 Cell: (b) (6)

	Pager:	713-716-3850
	Home:	(b) (6)
Pat Flowers	Phone:	281-332-0914
	Cell:	(b) (6)
	Pager:	1-800-299-4099 (ID 4320)
	Home:	(b) (6)
Scott Hathaway	Phone:	713-475-0106
	Cell:	(b) (6)
	Pager:	713-612-2289
	Home:	(b) (6)

DIRECTIONS: Interstate 10 East to Spur 330 (Decker Drive), take right. Stay on Decker Drive to ExxonMobil Refinery's south guard gate. Guard will direct to equipment (equipment is stored with Houston Ship Channel ELIRT's equipment).

EXXONMOBIL REFINING & SUPPLY COMPANY

5000 Bayway Drive
Baytown, Texas 77520

REPRESENTATIVE:	Bill Hennessey
Phone:	281-834-3202
Cell:	(b) (6)
Email:	william.s.hennessey@exxonmobil.com

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

Dock Operations	281-834-4452 (24 hr.)
Refinery Shift Superintendent	281-834-5305 (24 hr.) First for authorization response
	281-834-4452 (24 hr.) Back-up phone number

DIRECTIONS: From I-10 East take Spur 330 (Bayway Drive) South 4 miles to Exxon Refinery South Gate.

GEORGIA GULF CORPORATION

P. O. Box 1959
Pasadena, TX 77501

REPRESENTATIVE:	Pedro Hernandez
Phone:	713-920-4365
Fax:	713-920-4389
24 hr:	713-920-4308
Pager:	281-434-8203
Email:	hernandezp@ggc.com

ALTERNATE:	Ms. Denise O'Brian
------------	--------------------

Phone: 713-920-4317
 Home: (b) (6)
 Pager: 1-800-585-8460
 Email: obriand@ggc.com

DIRECTIONS: Take 225 East to Beltway 8 exit, U-turn under 225. Turn right at entrance.

HOUSTON FUEL OIL TERMINAL COMPANY

16642 Jacinto Port Blvd.
 Houston, Texas 77015

REPRESENTATIVE: Paul Roubieu

Phone: Paul Roubieu
 Email: paul@hfotco.com
 Office: 713-984-7535
 Fax: 713-984-7585
 Cell: (b) (6)

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

Johnny Alaniz 281-452-3390
 Email: Johnny@hfotco.com
 Cell: (b) (6)

Billy Dewey 281-452-3390
 Email: billy@hfotco.com
 Cell: (b) (6)

DIRECTIONS: Take I-10 East to Sheldon Road Exit. Turn right on Sheldon until Sheldon dead ends. Turn left onto Jacinto Port Blvd. After R. R. tracks take left hand fork and go one mile. Houston Fuel Oil Terminal is on the right.

KIRBY CORPORATION

18350 Market Street
 Channelview, TX 77530

REPRESENTATIVE: Jim Guidry

Cell: (b) (6)
 Office: 713-435-1600
 Direct Houston 713-435 -640
 Direct Baton Rouge: 225-201-3002
 Houston Fax: 713-435 -606
 Baton Rouge Fax: 225-201-3090

Home : (b) (6)
 Email: jim.guidry@kirbycorp.com

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

Phone: Russell Hooper
 713-435-1805
 Pager: russell.hooper@kirbycorp.com
 Cell: (b) (6)
 Fax: 713-435-1818
 Email: russell.hooper@kirbycorp.com

LBC HOUSTON, L.P. 11666 Port Road Seabrook, Texas 77586

REPRESENTATIVE: Glen Davis
 Phone: 281-291-3417
 Fax: 281-291-3486
 Cell: (b) (6)
 Email: g-davis@lbctf.com

LyondellBasell HOUSTON REFINING LP 12000 Lawndale Houston, TX 77017

REPRESENTATIVE: Jim Roecker

 Phone: 713-321-4501
 Fax: 713-321-6900
 24-hr: 713-321-4211 (main gate)
 Email: james.roecker@lyondellbasell.com

ALTERNATE:
 Pete Greco 713-321-4325
 Cell: (b) (6)
 Fax: 713-321-6820
 Email: peter.greco@lyondellbasell.com

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

Jim Daniel 713-321-4496
 Fax: 713-321-6251
 Email: jim.daniel@lyondellbasell.com

Jeff Windham 713-321-4255
 Cell: (b) (6)
 Fax: 713-321-6820

Email: jeff.windham@lyondellbasell.com

Plant Shift Suptd. 713-321-4223

DIRECTIONS: Take 225 East to Allen Genoa exit and turn left under the freeway. Go to Lawndale and turn right, proceed to the entrance to the facility.

LYONDELLBASELL CHEMICALS

8280 Sheldon Road
Channelview, Texas 77530

REPRESENTATIVE: Art Board IV

Phone: 281-452-8180
Fax: 281-457-8098
Email: Art.BoardIV@lyondellbasell.com
24-hr: 281-452-8345

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

David Gray	281-452-8718	Fax: 281-457-8098
John Barnett	281-452-8334	Fax: 281-457-8098

DIRECTIONS: Take Beltway 8 North to Wallisville. Turn right on Wallisville and proceed to Sheldon. Turn left on Sheldon and proceed to the entrance to the facility.

MAGELLAN TERMINALS HOLDINGS, L.P.

12901 American Petroleum Road
P. O. Box 52
Galena Park, TX 77547

REPRESENTATIVE: Cindy Kraft

Phone: 713-330-2716
Cell: (b) (6)
Fax: 713-330-2717
Email: cindy.kraft@magellanlp.com

Gerald Norris
Phone: 713-330-2758
Fax: 713-330-2717
Email: gerald.norris@magllenlp.com

John Lawton
Phone: 713-330-2708
Cell: (b) (6)
Fax: 713-330-2717

Email: john.lawton@magellanlp.com

Vince Callarman
 Phone: 713-330-2715
 Cell: (b) (6)
 Fax: 713-330-2717
 Email: vince.callarman@magellanlp.com

DIRECTIONS: From Houston, take I-10 East to Federal Road exit. Turn south onto Federal and drive to American Petroleum Road and turn left.

ODFJELL TERMINALS (HOUSTON) L.P.

12211 Port Road
 Seabrook, Texas 77586

REPRESENTATIVE: Drew Wharton

Phone: 713-844-2367
 24-hr: 713-844-2300
 Fax: 713-844-2388
 Email: drew.wharton@odfjell.com

ALTERNATE: Dodie Gober
 Phone: 713-844-2362
 Email: dodie.gober@odfjell.com

OTHERS AUTHORIZED TO RELEASE EQUIPMENT

Dave Stephens 713-844-2383
 Fax: 713-844-2388

DIRECTIONS: Take 225 East to 146 South to Port Road. Turn at stop sign, ½ mile on left.

PASADENA REFINING SYSTEM INC.

111 Red Bluff Road
 Pasadena, Texas 77506

REPRESENTATIVE: Alisa White

Phone: 713-920-4176
 Cell: (b) (6)
 Email: awhite@pasadenarefining.com
 24-hr: 713-472-2461 (for emergencies extension 1310 and ask for environmental "On-Call")

ALTERNATE: Don Davis

Phone: 713-920-3942

Cell: (b) (6)
 Email: ddavis@pasadenarefining.com

DIRECTIONS: Take Red Bluff Exit off 225. Go north toward the ship channel on Red Bluff ½ mile to Witter Street. Turn right and go ½ mile on left to Crown “marine” gate. (Gate #13)

PORT OF HOUSTON AUTHORITY

111 East Loop North
 Houston, TX 77029

REPRESENTATIVE: Ruben Arredondo

Phone: 713-670-2636

SEARIVER MARITIME, INC.

P.O. Box 1512
 Room-EMB 4.088
 Houston, Texas 77251

REPRESENTATIVE: Paul A. Caruselle

Phone: 713-656-2094
 Cell: (b) (6)
 Pager: 800-636-4198
 Email: paul.a.caruselle@exxonmobil.com

ALTERNATE: Todd A. Covini

Phone: 713-656-2531
 Cell: (b) (6)
 Email: todd.a.covini@exxonmobil.com

DIRECTIONS: See **ExxonMobil Refining & Supply Company**

SHELL OIL COMPANY

5900 Highway 225
 Deer Park, Texas 77536

REPRESENTATIVE: Mike Boaze

Phone: 713-246-1120
 Main Gate: 713-246-7301
 Pager: 1-800-625-9428
 Cell: (b) (6)
 Fax: 713-246-6798
 Email: mike.boaze@shell.com

ALTERNATE: Ed Grosse
 Phone: 713-246-4246
 Pager: 713-606-0259
 Fax: 713-246-6798
 Cell: (b) (6)
 Email: edward.grosse@shell.com

Glenn Reyes
 Phone: 713-246-6650
 Pager: 713-606-3757
 Cell: (b) (6)
 Email: glenn.reyes@shell.com

Keith M. Jacob
 Phone: 713-246-1041
 Pager: 713-606-6948

OTHERS AUTHORIZED TO RELEASE EQUIPMENT:

Don Pogue
 Phone: 713-246-3918
 Pager: 713-606-9674
 Home: (b) (6)

Nick Wolfe
 Phone: 713-246-6065
 Pager: 713-549-4741
 Home: (b) (6)

DIRECTIONS: Eastbound on Highway 225 to Deer Park, exit Center Street. Turn left at traffic light, left onto feeder. Stay on feeder to entrance to Dock Road. Turn right into Shell, continue to Shell dock gate.

SHELL PIPELINE COMPANY

404 Jefferson
 Pasadena, TX 77506

REPRESENTATIVE: Phillip Barker
 Phone: 713-423-3382
 Fax: 713-423-3370
 Cell: (b) (6)
 24 hr. Pipeline Control Center 1-800-922-3459
 Email: phillip.barker@shell.com

ALTERNATE: Gerald Yandell
 Phone: 713-423-3341
 Fax: 713-423-3370
 Cell: (b) (6)

Keli Wall

Phone: 713-241-9563
 Cell: (b) (6)
 Email: keli.wall@shell.com

TARGA MIDSTREAM SERVICES LLC

P. O. Box 485
 12801 American Petroleum Road
 Galena Park, TX 77547

REPRESENTATIVE: David Clark

Phone: 713-450-7206
 Fax: 713-453-0736
 24-Hr. pager: 713-719-1010
 24-Hr. cell: (b) (6)
 Control Room: 713-450-7243
 Email: DBClark@targaresources.com

Facility Administrator : Anissa Smith
 Office: 713-450-7201

DIRECTIONS: I-10 East to Federal Road. Turn south on Federal Road. Cross over second set of railroad tracks, drive to American Petroleum Road and turn left.

TARGA TERMINALS LLC – Channelview
 Rex P. Bryan
 16514 DeZavala Road, Suite #3
 Channelview, TX 77530

Phone/24 hr. 281-457-1348
 Fax: 713-888-3638
 Cell/24 hr. (b) (6)
 Email: RBryan@targaresources.com

VALERO REFINING-TEXAS, L.P.

9701 Manchester Avenue
 Houston, Texas 77012

REPRESENTATIVE: Lynn Hoyt

Phone: 713-923-3568 24-hr: 713-923-3506
 Fax: 713-923-3505 Email: lynn.hoyt@valero.com

ALTERNATE: Bruce King

Phone: 713-923-3589
 Fax: 713-923-3505
 Cell: (b) (6)
 Email: bruce.e.king@valero.com

DIRECTIONS: After crossing the 610 bridge southbound, take the Manchester exit. Go east 1.5 miles, the entrance is on the left.

WESTWAY HOUSTON #2

7600 JW Peavy
 Houston, TX 77011

REPRESENTATIVE: Jimmy Ritter

Phone: 713 923-2736 ext105
 Fax: 713-923-1308
 24 hr.: 713-306-0952
 Cell: (b) (6)
 Email: jimmy.ritter@westway.com

ALTERNATE: Brian Kleczkowski

Phone: 713-514-1023
 Fax: 713-924-5032
 Cell: (b) (6)
 Email: briank@westway.com

ALTERNATE: Ken Shoemake
 HSEQ Regional Manager
 Westway Group, Inc.
 14015 Park Dr., Ste 206
 Tomball, TX 77377

Phone: 281-290-2055
 Cell: (b) (6)
 Fax: 281-290-2074
 Email: kens@westway.com

WILLIAMS MIDSTREAM/WILLIAMS FIELD SERVICES GULF COAST COMPANY

2800 Post Oak Boulevard
 Houston, Texas 77056
 P.O. Box 1396, MD 7101-Level 7
 Houston, Texas 77251-1396

REPRESENTATIVE: Russ Korbe

Phone: 713-215-3035
 Fax: 713-215-3163

Email: russell.korbe@williams.com
Cell: (b) (6)

ALTERNATE: Ky Nichols

Phone: 918-573-5623
Fax: 918-573-6499
Email: ky.nichols@williams.com

4. RESOURCES

The resources available to CCA for response activities are listed on the following pages. CCA maintains the highest OSRO classification: MM/W1-W3, River/Canal/Inland, for Facilities and Vessels in both Houston and Port Arthur COTP zones. CCA is also certified as a Discharge Cleanup Organization by the Texas General Land Office.

RESOURCE SUMMARY CLEAN CHANNEL/MEMBERS/CLEAN CHANNEL CONTRACTOR

	6 HRS	REQUIRED
Containment Boom	69,050'	30,000'
Derated Recovery Capacity	55,813 bpd	50,000 bpd
Storage Capacity	(b) (7)(F), (b) (3)	

Note -Storage Capacity -Effective storage is 24,000 BBLs per day greater than actual storage capacity due to Houston Fuel Oil's ability to decant 1,000 BBLs per hour of recovered oil into a process system at one of Houston's refineries.

CLEAN CHANNEL OWNED EQUIPMENT



Decontamination Trailer



GT-185 Skimmer



LORI Skimmer



Small Pump



Skimmer



Sludgemaster Pump



JBF Skimmer

Section 4.1.1

**CLEAN CHANNEL ASSOCIATION, INC.
MEMBERS'/CLEAN CHANNEL BOOM EQUIPMENT**

Owner/Location	Mfr.	Model No.	Boom Code	Length (feet)	Float (inches)	Skirt (inches)	End Code	Response Time
Clean Channel 2 Barge/Houston	Am. Boom & Barrier	Mark II		1,000	12	6	ASTMZ	
Clean Channel 3 Barge/Galveston	Am. Boom & Barrier	Mark II (XB5)		1,000	12	6	ASTMZ	
Clean Channel/Freeport	Am. Boom & Barrier	Mark II-C		500	24	12	ASTMZ	
Clean Channel/Freeport				1,500	16	8		
Clean Channel/Galveston				2,500	12	6		
Clean Channel/Pasadena office				1,850	12	6		
Clean Channel/Pasadena office				2,100	12	12		
Clean Channel/Pasadena office				2,000	6	4		
Clean Channel/Pasadena office	Am..Boom & Barrier	Mark II-C		1,100	24	12		
Clean Channel/Shell Oil/Deer Park				1,600	12	12		
Clean Channel/Westway Terminals				1,000	12	12		
Clean Channel/Monument-Battleship				850				
Dow Chemical/Freeport	Acme OK Corral			2,000	12	6	ASTMZ	
Enterprise/Baytown	Uniroyal Seal D			800			BOLT	
Enterprise/Freeport	Uniroyal			3,000	12	6		
Enterprise/Texas City	Uniroyal			3,600	12	6	BOLT	
ExxonMobil/Baytown	Various		R	1,900	12	6	ASTM	
ExxonMobil/Baytown	Various		F	2,500	12	6	ASTM	
ExxonMobil PL/LaPorte	Containment System			2,000	12	6	US	
Georgia Gulf/Pasadena	Acme		R	900	12	6	US2	2 hrs.
Houston Fuel Oil/Houston	Beta IB			7,000	18		US	
Kirby/Channelview	Acme	OK Corral		4,700				
LBC Houston/Houston	Acme			1,300	12	6	US2	
Lyondell Equistar/Channelview	Texas Boom			1,800	12		US	
LyondellBasell/Houston	Seagull			4,000	18		US	
Magellan/Galena Park				2,500				
Odjell Terminals/Houston	Acme	OK Corral		800	12	6	US1	
Pasadena Refining System	Acme		F	3,200	12	6	US2	2 hrs.
Shell Oil/Deer Park	Acme	OK Corral	R	4,700	12	6	US2	1 hr.
Shell Pipeline/Houston	Acme			550				
Shell Pipeline/Houston	Acme		R	1,000	12	6	ASTMZ	
Targa Midstream Svc./Galena Park	Am. Boom & Barrier		R	1,800	12	6		2 hrs.
Valero Refining-Texas	Acme	OK Corral		2,000	12	6	Z	

Code Legend:**Boom Type Codes End Connector Codes**

F Fence

ASTM ASTM STD (962-86)

US1 Universal Slide Type 1

Response Time:

R Round

BOLT Bolt Connect

US2 Universal Slide Type 2

2 hrs. unless otherwise noted

Section 4.1.5

**CLEAN CHANNEL ASSOCIATION, INC.
MEMBERS'/CLEAN CHANNEL SKIMMER EQUIPMENT**

Owner Location	Mfr.	Model No.	Skimmer Type Code	Number of Units	Mfg. Recovery Rate (gpm)	Hose Suction/Disch.	Time to Deploy
Clean Channel	LORI	LBC-3	OB	1	540	N/A	2 hrs.
Clean Channel	LORI	LBC-2	OB	1	360	N/A	2 hrs.
Clean Channel	Douglas Skimpak	18500/18000	W	5	2100	3"/3"	2 hrs.
Clean Channel	Crucial	ALWEIR-3	W	2	900	3"	2 hrs.
Clean Channel	Douglas Skimpak	2500	W	1	58		
Clean Channel	Poppet	Sludgmaster	OT	1	116	3"	2 hrs.
Clean Channel	Pharos Marine	GT185	W	1	200	3"	2 hrs.
Clean Channel	T & T Marine	Barge	W	2	920	3"/3"	2 hrs.
Clean Channel	JBF	DIP 402	W	2	352		2 hrs.
Clean Channel Barges		Elastec	D	2	140		
Clean Channel	Abasco	SSK8	W	1	1000		
Enterprise/Texas City	Douglas Skimpak	2500	W	1	58	1-1/2"	2 hrs.
ExxonMobil/Baytown	Douglas Skimpak	2500 series	W	1	58	1-1/2"	minutes
ExxonMobil/Baytown	Douglas Skimpak	2500	W	1	58	1-1/2"	30 min.
ExxonMobil	Slickbar		OT	2	160		1 hr.
Houston Fuel Oil/Hou	Teel		W	1	180	2"	1 hr.
Lyondell/Channelview	Douglas Skimpak		W	2	116	1-1/2"	1 hr.
Pasadena Refining System	Acme	FSV39	W	1	100	2"/2"	1 hr.
Shell Oil/Deer Park	Mini Foilex		OD	1	130		
Shell Oil/Deer Park	Micro Foilex		OD	1	65		
Shell Oil/Deer Park	Desmi Mini Max		FS	1	220		
Shell Oil/Deer Park	Douglas Skim Pack	4200	W	1	95		
Shell Oil/Deer Park	SLURP Skimmer		FS	1	44		
Shell Oil/Deer Park	Weir Skimmer	FSV 39	W	1	120		
Shell Pipeline/Hou	Douglas Skimpak	2500	W	1	58	1-1/2"	1 hr.

Code Legend:**Skimmer Type Codes**

FS Floating Suction
HIP Hydrodynamic Inclined Plane

IV Induced Vortex
OB Oleophilic Belt
OD Oleophilic Disk

W Weir
OT Other
D Drum

Section 4.1.6

**CLEAN CHANNEL ASSOCIATION, INC.
MEMBERS'/CLEAN CHANNEL LIQUID RECOVERY STORAGE EQUIPMENT**

Owner/Location	Mfr.	Model No.	Design Type Code	Number of Units	Capacity (barrels)
					(b) (7)(F), (b) (3)
Clean Channel/Houston		N/A	SV	1	[REDACTED]
Clean Channel/Freeport		N/A	D	1	
Houston Fuel Oil/Channelview	Unknown	N/A	OF-shore side tank	1	
Enterprise Marine Services/Highlands	Unknown	N/A	CB-tank barge	1	
Kirby Fleet /Greens Bayou	Unknown	N/A	CB-tank barge	4	
LyondellBasell/Houston	Unknown	N/A	TT	1	
T&T Marine Salvage/Galveston	T&T Marine	N/A	SV	1	
In water at Galveston & Houston	T&T Marine	N/A	CB/SV	2	

**Code Legend:
Design Type Code**

CB Compartment Barge
D Dracone (bladder)
HB Hopper Barge
OF Oil Field Tank
PL Plastic Swimming Pools
SV Skimmer Vessel
TT Tank Truck
OT Other

Section 4.1.2

CLEAN CHANNEL ASSOCIATION, INC.
MEMBERS'/CLEAN CHANNEL PUMP EQUIPMENT

Owner/Location	Mfr.	Model No.	Pump Code	Drive Code	Suction/Disch Size (inches)	Mfg. Pump Rate (gpm)
Clean Channel/Pasadena, TX	Yanmar	L-40	C	D	3"/3"	300
Clean Channel/Pasadena, TX	Yanmar	L-40	C	D	3"/3"	300
Clean Channel/Freeport, TX	Yanmar	L-40	C	D	3"/3"	300
Clean Channel/Pasadena, TX	Diesel Am.	3D-L40	D	D	3"/3"	80
Clean Channel/Pasadena, TX	Sludgemaster	Popet		H	3"/3"	
Dow Chemical/Freeport	Yanmar					100
Enterprise/Texas City	Yanmar					100
ExxonMobil/Baytown	Homelite	DTP 3-1	C	D	3"	350
ExxonMobil Pipeline/Houston	Honda			G	2"/2"	100
Houston Fuel Oil/Houston	Teel		G		2"/2"	180
Shell Oil/Deer Park			G		2"/2" (2)	60
Shell Pipeline/Houston	Gorman-Rupp		C	D	1"/2"	25
Shell Pipeline/Houston	Peabody Barnes				3"	100
Shell Pipeline/Houston	Viking				4"	700
Shell Pipeline/Pasadena	Honda	WB30X	C	G	3"/3"	264
Shell Pipeline/Pasadena	Teel	3P613A	R	G	3"/3"	88
Shell Pipeline/Pasadena	Thompson	3D-DL104	R	D		88
Shell Pipeline/Pasadena	Homelite	12053	C	G	3"/3"	216
Valero Refining-Texas	Wilden	M8	R	P	2"/1-1/2"	280
Valero Refining-Texas	Honda		G			110
T&T Marine Salvage/Galveston				G	2"/2" (3)	300
T&T Marine Salvage/Galveston				D	3"/3" (2)	480
T&T Marine Salvage/Galveston					2"/2" (3)	360
T&T Marine Salvage/Galveston					4"/4" (4)	1680

Code Legend:**Pump Codes**

C Centrifugal
D Diaphragm
R Reciprocating
G Rotary Gear

Drive Codes

D Diesel
G Gasoline
H Hydraulic
P Pneumatic

Section 4.1.3

**CLEAN CHANNEL ASSOCIATION, INC.
MEMBERS'/CLEAN CHANNEL RESPONSE BOATS**

Owner/Location	Mfr.	Model No.	Boat Type Code	Horse Power	Normal Crew Size	Length/ Beam	Draft Limitations	Trans. Method Code
Clean Channel	Empire	1760	LFB	40 hp	2	17'	1'	WO
Clean Channel	Empire	1760	LFB	40 hp	2	17'	1'	WO
Clean Channel/Galveston	Boston Whaler		Bay	150 hp	3	18'		NT
Enterprise/Baytown Empire			LFB	115 hp		20'		NT
ExxonMobil/Baytown	Monark		LFB	(2) 70 hp	2	22'	1'	NT
ExxonMobil./Baytown	Trail Boss		Bay/TC	(2) 70hp		22'	1'	NT
ExxonMobilPL/LaPorte	Wellcraft			70 hp		18'		NT
Houston Fuel Oil/Hou	Lowe			35 hp		16'		OT
Houston Fuel Oil/Hou	Monark		JB	25 hp	2	16'	1'	NT
Kirby/Houston	Unknown	None	TC-Towboat	min 800	3			WO
Kirby/Houston	Unknown	None	TC-Towboat	min 800	3			WO
Kirby/Houston	Monark			200 hp		21'		NT
LBC Houston/Houston	Alumaweld	1650	JB	25 hp	2	16'	1'	WO
LyondellBasell/Hou	Lowe		JB	50 hp	2			WO
LyondellBasell/Hou	Lowe		JB	120 hp	2			NT
Lyondell/Channelview		Jon	JB	25 hp		16'		OT
Magellan/Galena Park	Custom Flats	1654	JB	30 hp	2	16'x54"	1'	WO
Shell Oil/Deer Park	Alumaweld	1650	JB	25 hp	3	16'x76"	1'	NT
Shell PL/Houston		Jon		9.5 hp		14'		OT
Shell PL/Houston	Unknown			35 hp		16'		OT
Shell PL/Pasadena	Empire	1769	LFB	90hp	6	17'/6'9"		NT
Valero Refining-Texas	Alumaweld	1650HC	LFB	25 hp		16'		NT
Valero Refining-Texas	Alumaweld	1650LO	JB	40 hp		16'		NT
T&T Marine Salvage/Gal	Various					16' (4)		

Code Legend:

BAY Bay Waters
JB Johnboat
LFB Large Flat Bottom

Response Boat Type Codes

OFF Offshore
PRO Protected Waters
TC Towing Capable
OT Other

Transportation Method Codes

NT Normal Trailer
WO Water Only
WL Wideload Trailer

Section 4.1.4

**CLEAN CHANNEL ASSOCIATION, INC.
MEMBERS'/CLEAN CHANNEL HEAVY EQUIPMENT/RESPONSE VEHICLES**

Owner/Location	Mfr.	Heavy Equipment/ Response Vehicle	Number of Units	Wide Load Permit?	
				Yes	No
Clean Channel/Houston	Advanced Containment Systems	35' Decontamination Trailer	1		X
LyondellBasell/Houston		Decontamination Trailer	1		X
LyondellBasell/Houston		Hazardous Materials Trailer	1		X
Shell Oil/Deer Park		Incident Command Center	1		X

4.2.1 OIL SPILL RESPONSE RESOURCES AND EQUIPMENT

CCA has established relationships with both local and gulf coast area spill contractors who have the resources to conduct cleanup activities. Their services are available to CCA members.

- A. T&T MARINE SALVAGE, INC.**
9723 Teichman Road
Galveston, TX 77554
Office: 409-744-1222; 281-488-5757
- B. GARNER ENVIRONMENTAL SERVICES, INC.**
1717 W. 13th Street
Deer Park, TX 77536
Office/24 hr: 281-930-1200
- C. OIL MOP, INC.**
145 Keating Drive
Bellechasse, LA 70037
Office: 504-394-6110
- D. MILLER ENVIRONMENTAL SERVICES, INC.**
600 Flato Road
Corpus Christi, TX 78405
Office: 361-289-9800
- E. EAGLE CONSTRUCTION & ENVIRONMENTAL**
1700 North "E" Street
LaPorte, TX 77571
Office: 281-867-9131
24 hr.: 800-336-0909
- F. BAYOU CITY PUMP WORKS, INC. (pumps only)**
8139 Tidwell Road
Houston, TX 77078
Office: 713-631-6451
Fax: 713-631-1319
- G. ANDERSON POLLUTION CONTROL, INC.**
812 W. D Street
LaPorte, TX 77571
Office: 281-479-53

- H. PHOENIX POLLUTION CONTROL & ENVIRONMENTAL SERVICES, INC.**
720 S. Lynchburg Road
Baytown, TX 77520
Office: 281-838-3400
- I. Clean Gulf Associates**
New Orleans, LA 70151
Office: 504-799-3035
- J. MARINE SPILL RESPONSE CORPORATION (MSRC)**
Houston, Texas
281-776-4310
- K. NATIONAL RESPONSE CORPORATION (NRC)**
11200 Westheimer, Suite 850
Houston, TX 77042
Office: 713-977-9951 or 1-800-899-4672 for emergencies

4.2.2 FIREFIGHTING

There are several sources of assistance in fighting fires in the Houston/Galveston area in addition to local, municipal fire departments. Some of these resources are limited in their knowledge of shipboard fires, a fact that must be continuously considered during a shipboard fire. **REMEMBER TO GET THE SHIP'S FIREFIGHTING PLAN FROM THE RED TUBE AT THE TOP OF THE GANGWAY.**

A. CIMA (CHANNEL INDUSTRIES MUTUAL AID)

Houston Area (24)713-473-9191

CIMA is an industry mutual aid organization. Member companies respond with landside resources, both personnel and equipment, to assist the member experiencing an emergency. The member experiencing the emergency directs response operations.

B. PORT OF HOUSTON FIREBOATS

All Boats.....713-670-3620

The Port of Houston maintains fireboats at Barbours Cut, Greens Bayou, and Woodhouse Terminal in Galena Park. They are continuously manned by a Captain and an engineer, and draw firefighters from the local fire station.

The Bracewell and Tellepsen are 68' in length, each equipped with two 2000 gpm pumps and three monitors; and carry 1000 gallons of foam. The Captain Farnsworth is 80' in length and has two 3000 gpm pumps and three monitors, and carries 2000 gal. of foam.

C. WILLIAMS FIRE & HAZARD CONTROL, INC.

1675 Texla Road

Vidor, TX 77662

Office: 409-727-2347; 1-800-231-4613

Emergency: 281-999-0276 Houston, TX

D. WILD WELL CONTROL INC.

22730 Gosling Road, Spring, Texas 77389

Office: 281-353-5481

E. SEABROOK FIREBOAT

Office: 281-474-2101

The Seabrook Volunteer Fire Department has a fireboat located at Seabrook.

4.2.3 LIGHTERING

In many spill events it is necessary to lighter cargo. In addition to CCA's lightering capability the following firms offer pumping services for lightering operations.

A. MARIFLEX

Pasadena Texas 77503

Office: 713-534-7100

VAC TRUCK COMPANIES**B. UVAC**

3120 Pasadena Freeway

Pasadena, TX 77503

Office: 713-473-5588

24-hr. 1-888-696-8822

www.uvac.com**C. SWS ENVIRONMENTAL SERVICES**

1700 North E St

La Porte, TX 77571, United States

(281) 867-9131

www.swsenvironmental.com**4.2.4 SALVAGE**

Vessels and waterfront facilities involved on casualties may need assistance in stabilizing the situation and eliminating further threat. This is typically through effecting temporary hull repairs and removing a grounded/sunken vessel. Resources in the Houston/Galveston area offering those services are listed below.

A. T & T MARINE SALVAGE, INC.

9723 Teichman Road
Galveston, Texas
Office: 281-488-5757

4.2.5 DISPOSAL SITES

The preferred method of disposal for oil recovered from the water's surface is to reclaim the oil by reprocessing it at a local refinery. The facility to which the oil was destined will be the facility of choice. The following are firms which can handle disposal of recovered oil/debris which cannot be reclaimed.

A. CLEAN HARBORS

Deer Park, Texas
Office: 281-930-2300

Should a temporary site be necessary to store debris, the site selected must be covered with a liner to prevent further ground contamination. If possible a shallow excavation should be made to prevent run-off. If not possible a "ditch", also lined, should be dug around the temporary storage site to contain the run-off, which may be caused by rain or the oil itself heating and becoming fluid. A source of lining material is:

POLY-FLEX POLYETHYLENE GEOMEMBRANES

2000 West Marshall Drive
Grand Prairie, Texas 75051
Office: 972-647-4374 Ext. 7269 Emergency: 1-800-527-3322
Fax: 972-337-7233

4.2.6 AVIATION RESOURCES

During a medium or major spill, it is necessary to use aircraft to track the oil, direct response efforts, and document through photography.

A. PHI

24-hour phone: 337-235-2452

B. PARADIGM HELICOPTERS

Houston: 877-345-8687

4.2.7 PUBLIC AFFAIRS**MEDIA CONSULTANTS**

4710 Castlewood Street
Sugarland, TX 77479
Phone: 281-980-1400

4.2.8 SPILL MANAGEMENT

The following offer assistance in various aspects of managing a spill.

A. SPILL MANAGERS

O'BRIEN'S OIL POLLUTION SERVICE (OOPS)/ERST-O'BRIEN

Jim O'Brien
Slidell, LA 70456
504-781-0804

TRG

Houston, TX
281-880-5000

B. COST ACCOUNTING AND CLAIMS PROCESSING

GAB ROBINS ENVIRONMENTAL, INC.

Kingwood, TX 77339
1-800-343-2153

C. SCIENTIFIC AND TECHNICAL SUPPORT/PLAN DEVELOPMENT

ROBERT SIMMONS CONSULTING

Slidell, LA 70461
504-643-4683

TECHNICAL RESPONSE PLANNING

281-955-9600

D. OILED WILDLIFE RESPONSE

WILDLIFE RESPONSE SERVICES LLC

P. O. Box 842
Seabrook, TX 77586
Rhonda Murgatroyd
713-705-5897

Pager: 281-266-0054

BAY AREA WILDLIFE REHABILITATION (BAWR)

Michele Johnson - 281-992-8080 or Rhonda Murgatroyd - 713-705-5897

WILDLIFE REHAB AND EDUCATION WILDLIFE CENTER

Houston, TX 77024
Sharon Schmalz
713-861-9453

TEXAS PARKS & WILDLIFE DEPARTMENT

24 hr. Communications Center 512-389-4848

Office: 512-912-7016 Pager: 512-896-2705

U. S. FISH & WILDLIFE SERVICE

24 hr.: 281-480-7418 Office: 281-286-8282

E. TOWBOATS

Kirby Marine

Dispatch 713-435-1859

T&T Marine Salvage, Inc.

Dispatch 281-488-5757

KEY PHONE NUMBERS

CLEAN CHANNEL ASSOCIATION, INC (24 hours)	713-534-6195
T&T MARINE SALVAGE, INC.	281-488-5757
USCG SECTOR HOUSTON-GALVESTON	713-671-5113
NATIONAL RESPONSE CENTER (Report all spills)	800-424-8802
TEXAS GENERAL LAND OFFICE (Report all spills)	
24-hour number	800-832-8224
LaPorte office	281-470-6597
PORT OF HOUSTON (Dispatch for all emergencies)	713-670-3620
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY	512-239-2507
U.S. ENVIRONMENTAL PROTECTION AGENCY (Region VI –Dallas).....	866-372-7745
FBI.....	713-693-5000
GALVESTON BAY FOUNDATION.....	281-332-3381
GALVESTON COUNTY EMERGENCY MANAGEMENT (24 hours).....	281-309-5002
HARRIS COUNTY HOMELAND SECURITY/EMERGENCY MGMT	713-881-3100

NATIONAL HOTLINES

Association of Poison Control Centers.....	800-222-1222
Center for Disease Control.....	404-633-5313
CHEMTREC.....	800-424-9300
DOT Hazardous Materials Information.....	202-366-4488
Federal Emergency Management Agency.....	800-621-3362
Houston Transtar	713-881-3000
National Pesticides Network	800-858-7378
Occupational Safety and Health Adm.	800-321-6742

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GARNER ENVIRONMENTAL SERVICES, INC.

**1717 West 13th Street
Deer Park, Texas 77536
(281) 930-1200
(800) 424-1716**

**RESPONSE RATE SCHEDULE
DOMESTIC**

June 2011

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

TABLES OF CONTENTS

Spill Response Office Phone Numbers	iii
DEER PARK.....	iii
PORT ARTHUR	iii
LA MARQUE/GALVESTON	iii
Automotive Equipment	1
Equipment Decontamination / Washout.....	1
Haz-Mat Rates	1
Insurance.....	1
Personnel	1
Replacement of Damaged or Contaminated Equipment.....	1
Roll-Off Boxes	1
Stand-By Rates	2
Subcontract Services / Third-Party Services.....	2
Taxes.....	2
Terms	2
Place of Performance.....	2
Travel, Lodging and Per Diem.....	2
Fuel Surcharge Table.....	3
PERSONNEL	
Spill.....	4
Haz-Mat.....	4
Rescue	4
EQUIPMENT	
Automotive Equipment	4 - 5
Marine Equipment	5
Containment Boom	5
Skimmers	5
Sorbent Material	6
Pumps and Hoses.....	6
Specialty Equipment.....	6 - 7
Communications Equipment	7
Haz-Mat Equipment.....	7
Miscellaneous Equipment	7
Monitoring Equipment	8
Rescue Equipment	8
Personal Protective Equipment.....	8 - 9
Boots	9
Gloves	9
Respiratory Protection.....	9
Sampling and Testing Equipment and Supplies	9 - 10
Storage	10
MATERIAL	
Chemicals.....	10 - 11
Miscellaneous Material	11

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

SPILL RESPONSE OFFICE PHONE NUMBERS

DEER PARK – Office / Phone: (281) 930-1200 / (800) 424-1716 Fax: (281) 478-0296

PORT ARTHUR – Office / Phone: (409) 983-5646 / (800) 983-7634 Fax: (409) 983-5851

LA MARQUE/GALVESTON – Office / Phone: (409) 935-0308 / (800) 935-0308 Fax: (409) 935-0678

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Automotive Equipment

Automotive Equipment Hourly Rates charges are portal to portal. A four (4) hour minimum time will be charged on all call-outs. Equipment / auto / truck charges do not include fuel, which will be invoiced separately. A mileage charge of \$0.50 per mile after the first 50 miles will be added for all Motorized Equipment, including automobiles and pick-up trucks, in addition to the applicable fuel surcharge(s). Unless GESI applies a flat fuel surcharge as referenced herein, fuel surcharges will be applied based on the Hourly/Daily Equipment/Vehicle rate on all Motorized Equipment pursuant to index on cost per gallon as reported by the Department of Energy EIA Retail On-Highway Gasoline and Diesel Prices. Fuel surcharge(s) will be invoiced as a separate line item. The fuel surcharge percentage is adjusted every Monday of each week based upon the weekly U.S. National Average. See page 3 for example [shown up to \$4.00] of how surcharges are calculated based on fuel price range, i.e., increase in fuel price range by .05% results in corresponding incremental increase in surcharge.

Equipment Decontamination / Washout

Time and Material charges are portal to portal and will continue through decontamination and/or washout of any and all equipment used on the job.

Haz-Mat Rates

Haz-Mat rates will be charged when the material being dealt with has a hazard rating of two or greater on the NFPA 704 labeling system or hazardous material identifying system, or if a job requires the use of respiratory protection.

Insurance

The rates in this RATE SCHEDULE include insurance coverage for Worker's Compensation, General Liability, Pollution and Automobile Liability. A Certificate of Insurance will be forwarded upon request.

Personnel

Experienced consulting, supervisory, technical instructor and equipment operating personnel are available for complete emergency spill response and spill cleanup operations and vacuum service, 24 hours a day, 7 days a week. Straight time rates will be billed from 0800 (8:00 a.m.) through 1600 (4:00 p.m.) daily, Monday through Friday. All other non holiday hours worked, including Saturday and Sunday will be billed at the Overtime rate. **DOUBLE TIME RATES** will be charged for all Garner recognized Holidays which include Christmas Day, New Years Day, Memorial Day, Fourth of July, Labor Day, and Thanksgiving Day. When these holidays fall on a weekend, the nearer weekday will be charged at the Overtime rate.

All labor charges will be in accordance with Garner Environmental Services, Inc. service receipts. Charges for personnel are portal-to-portal. Garner Environmental Services, Inc. will invoice for personnel and the time required to mobilize, service, repair, and restock all vehicles and equipment used in the performance of the services for customer. There will be a **4-Hour Minimum Service Charge On All Labor Call-Outs**.

In the event Garner Environmental Services, Inc. responds to a request from a governmental agency and/or third party and/or Customer and/or on behalf of Customer for record gathering and/or litigation support services, including but not limited to testifying at any proceeding, deposition, hearing or trial, and whether during the performance of services or any time after, Customer hereby agrees to and will pay to GESI, in accordance with the payment terms herein, the charges for the personnel provided and/or requested and/or required in the amount corresponding to the personnel designation in this rate sheet and will further reimburse GESI for reasonable expenses incurred as a result, including for transportation, parking and/or lodging, if necessary.

Garner Environmental Services, Inc. reserves the right to charge Customer for all items and adjustments made by third party negotiators, customer quality assurance personnel, third party management or auditors and the like.

At no time will post emergency response negotiated rates be allowed to become retroactive.

Replacement of Damaged or Contaminated Equipment

If, during performance of a service and/or services for a customer, equipment and/or material sustain damage which renders the equipment and/or material beyond repair or renders decontamination impossible, said equipment and/or material will be subject to a replacement charge at Garner Environmental Services, Inc.'s cost plus 15% unless said damage was sustained as a result of misuse by Garner Environmental Services, Inc. personnel.

Roll-Off Boxes

Roll-Off Box delivery and pickup charges vary according to the distance from the site location. The cost for roll-off box liners is \$50.00 each. Box Liners are not mandatory, but if the Roll-Off Box requires cleaning at the end of the rental period, the customer will incur the cleaning charges.

All rates listed in this schedule are subject to change without notice.

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Stand-By Rates

Stand-By Rates will be equal to the daily rates in this schedule unless otherwise agreed to in writing on a case-by-case basis. Full rates will apply for personnel and per diem.

Subcontract Services / Third-Party Services

When Garner Environmental Services, Inc.'s equipment is available, Garner Environmental Services, Inc. will use and bill Customer for said equipment at rates published in the rate schedule. For any item that is identified on Garner Environmental Services, Inc.'s rate sheet and which Garner acquires through or from a third party vendor or supplier, Customer will pay to Garner Environmental Services, Inc. the higher of Garner Environmental Services, Inc.'s rate or Garner Environmental Services, Inc.'s cost plus a 20% handling charge.

A 20% handling charge will apply and be invoiced for all shipping and transportation of equipment, materials and goods regardless of whether such equipment, materials and goods appear on Garner Environmental Services, Inc.'s rate schedule. In addition, for all items not listed on Garner Environmental Services, Inc.'s rate schedule, including but not limited to personnel, equipment, materials and goods, laboratory services, testing services, damage waivers and/or other services, said items will be billed at Garner Environmental Services, Inc.'s cost plus a 20% handling charge.

Cost, as used herein, is defined as the amount invoiced to Garner Environmental Services, Inc. by a third-party supplier of material and/or goods and/or material and/or labor and/or equipment and/or services.

Taxes

All domestic federal, state and municipal taxes, except income taxes and ad-valorem taxes, now and hereinafter imposed with respect to services rendered, to rental equipment, to the processing, manufacture, repair, and to the delivery and transportation of equipment and supplies will be added to and become part of the total price payable by the Customer. If a Customer claims an exemption from payment of Sales and Use Tax, the Customer will be required to render an Exemption Certificate or a Resale Certificate to Garner Environmental Services, Inc. for said exemption to apply to the services rendered. If for any reason the services rendered result in the assessment of foreign income taxes, excise taxes, or other fees alleged as owing to a foreign state or government, the Customer will pay directly the amount of any assessment or fee. In the event Company pays any such foreign tax or fee directly, Customer will promptly reimburse Company for same.

Terms

The term of payment for all invoices is *Net Payment Due Immediately Upon Receipt of Invoice in United States Dollars (US \$)*. The balance of any invoice not timely paid will accrue a finance charge computed at the periodic rate of one and one-half percent (1.5%) per month (18% per annum) beginning on the thirty-first (31st) day from the date of invoice. Customer is obligated to make payment to Garner Environmental Services, Inc. at its principal office at 1717 West 13th Street, Deer Park, TX 77536 in Harris County, Texas. It remains the Customer's obligation to pay all invoices regardless of insurance or third party claims.

Place of Performance

The procurement of Garner Environmental Services, Inc.'s services may not be in the same county as the work site area. Customer is obligated to make payment to Garner Environmental Services, Inc. in Harris County, Texas for services provided. Because this agreement has been procured in Harris County, Texas and is being managed and administered from Garner Environmental Services, Inc.'s central office in Harris County, Texas, this agreement is being performed in Harris County, Texas. The validity, interpretation and performance of the services and payment and the contents herein are to be interpreted and enforced pursuant to the laws of the State of Texas and any suit in connection herewith will be filed in Harris County, Texas.

Travel, Lodging and Per Diem

For all employees who perform work at a location over 50 miles from the employee's normally assigned Garner Environmental Services, Inc. branch office, Garner Environmental Services, Inc. charges for employee travel to and from the work site on the basis of Garner Environmental Services, Inc.'s incurred costs plus 20% for all commercial transportation. A minimum Per Diem charge of **\$150.00** per day for each such employee will be charged and due for each day that such employee is present in the locale of the work site. When working in high cost areas as defined by U.S. Government Travel Regulations, travel, lodging and per diem rates may increase.

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Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Fuel Surcharge Table

Fuel Price Range		Fuel Surcharge %
1.65	1.70	5.50
1.70	1.75	6.00
1.75	1.80	6.50
1.80	1.85	7.00
1.85	1.90	7.50
1.90	1.95	8.00
1.95	2.00	8.50
2.00	2.05	9.00
2.05	2.10	9.50
2.10	2.15	10.00
2.15	2.20	10.50
2.20	2.25	11.00
2.25	2.30	11.50
2.30	2.35	12.00
2.35	2.40	12.50
2.40	2.45	13.00
2.45	2.50	13.50
2.50	2.55	14.00
2.55	2.60	14.50
2.60	2.65	15.00
2.65	2.70	15.50
2.70	2.75	16.00
2.75	2.80	16.50
2.80	2.85	17.00
2.85	2.90	17.50
2.90	2.95	18.00
2.95	3.00	18.50
3.00	3.05	19.00
3.05	3.10	19.50
3.10	3.15	20.00
3.15	3.20	20.50
3.20	3.25	21.00
3.25	3.30	21.50
3.30	3.35	22.00
3.35	3.40	22.50
3.40	3.45	23.00
3.45	3.50	23.50
3.50	3.55	24.00
3.55	3.60	24.50
3.60	3.65	25.00
3.65	3.70	25.50
3.70	3.75	26.00
3.75	3.80	26.50
3.80	3.85	27.00
3.85	3.90	27.50
3.90	3.95	28.00
3.95	4.00	28.50

All rates listed in this schedule are subject to change without notice.

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

PERSONNEL

		Hourly	
		Spill Regular	Overtime
PERS-1001	Project/Operations Manager	150.00	225.00
PERS-1002	Health & Safety Manager	118.75	178.20
PERS-1003	Site Manager/Superintendent	82.00	123.00
PERS-1004	Site Safety Officer	79.00	118.50
PERS-1021	Zone Manager	100.00	150.00
PERS-1020	Project Accountant	70.00	105.00
PERS-1019	Disposal Coordinator	75.00	112.50
PERS-1013	Resource Coordinator	75.00	112.50
PERS-1017	Field Clerk	42.00	63.00
PERS-1005	Supervisor	59.00	88.50
PERS-1007	Foreman	47.00	70.50
PERS-1016	Technician	38.00	57.00
PERS-1014	Operator, Heavy Equipment	54.00	81.00
PERS-1015	Operator, Response Equipment	54.00	81.00
PERS-1010	Mechanic	85.00	127.50
Haz-Mat			
PERS-1004-HM	Site Safety Officer	109.00	163.50
PERS-1005-HM	Supervisor, Haz-Mat	114.00	171.00
PERS-1007-HM	Foreman, Haz-Mat	90.00	135.00
PERS-1016-HM	Technician, Haz-Mat	78.00	117.00
PERS-1014-HM	Operator, Heavy Equipment, Haz-Mat	84.00	126.00
PERS-1015-HM	Operator, Response Equipment, Haz-Mat	84.00	126.00
PERS-1016-TS	Technician, Sampling	55.00	82.50
Rescue			
PERS-1011	Rescue Supervisor	65.00	97.50
PERS-1012	Rescue Technician	55.00	82.50

EQUIPMENT**Automotive Equipment**

		Hourly Rate
AUTO-1003	*Vacuum Truck, 70bbl Capacity, Stainless Steel Unit (GES owned)	115.00
AUTO-1003-H	*Vacuum Truck, 70bbl Capacity, Stainless Steel Unit (GES owned) (Haz-Mat)..	140.00
AUTO-1004	*Vacuum Truck, 70 bbl Capacity (GES Owned)	100.00
AUTO-1004-H	*Vacuum Truck, 70 bbl Capacity, (GES Owned) (Haz-Mat)	125.00
AUTO-1043	Air Scrubber, GES Vacuum Truck Mounted	25.00/hr
AUTO-1044	Air Scrubber, GES Vacuum Truck Mounted, Consumables & Carbon	Cost Plus 20%, Min \$500.00
AUTO-1045	Air Scrubber, Large Volume for Air Mover Trucks	100.00/hr
AUTO-1046	Air Scrubber, Large Volume for Air Mover Trucks, Consumables & Carbon	Cost Plus 20%, Min \$750.00
AUTO-1027	Safety-Vac	60.00/hr
AUTO-1010	ATV, 4-Wheel	350.00/day
AUTO-1047	UTV, 4-Wheel Utility Vehicle (Side by Side)	425.00/day
AUTO-1011	ATV Utility Trailer	75.00/day
AUTO-1013	Backhoe (plus mobilization & demobilization)	425.00/day
AUTO-1017	Meyers Unit, Trailer Mounted	350.00/day
AUTO-1018	Pick-Up Truck, 1 ton or smaller	200.00/day
AUTO-1020	Pick-Up Truck, 1 ton, w/lift gate	225.00/day
AUTO-1023	Pick-Up Truck, 1 ton, 4x4	300.00/day
AUTO-1048	15 Passenger Van	325.00/day
AUTO-1024	Skid-Steer Loader (GES Owned)	350.00/day
AUTO-1028	Tractor/Trailer, Haz-Mat Response Unit, 32'	750.00/day
AUTO-1025	Trailer, Boom, 20 foot	75.00/day

All rates listed in this schedule are subject to change without notice.

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Automotive Equipment - Continued

		Hourly Rate
AUTO-1026	Trailer, Equipment Hauler, Gooseneck, 24 foot.....	75.00/day
AUTO-1029	Trailer, Haz-Mat Response, 24'	350.00/day
AUTO-1035	Trailer, Rescue/Emergency Response	200.00/day
AUTO-1030	Trailer, Response, Gooseneck, 32' Oil Response	300.00/day
AUTO-1031	Trailer, Transfer, Ship to Shore	125.00/day
AUTO-1032	Trailer, Utility	75.00/day
AUTO-1036	Trailer, Box 48'	200.00/day
AUTO-1037	Trailer, Box 53'	300.00/day
COMM-1006	MCC #1 Mobile Command & Control Trailer plus Fuel.....	300.00/day
COMM-1010	Command Trailer, 48'	1,800.00/day
AUTO-1038	Mileage (after the first 50 miles (except pick-up trucks)	0.50 per mile
AUTO-1039	Mileage (after the first 50 miles for pick-up trucks)	0.35 per mile

* Operator Included

Marine Equipment

		Daily Rate
MAR-1003	Response Boat, 28'-30',	1450.00
MAR-1004	Flat Boat, 14' to 16' w/o motor	125.00
MAR-1005	Flat Boat, 14' to 16' w/motor	225.00
MAR-1013	18'-22' Single engine boat	400.00
MAR-1010	Flat Boat 12'	100.00
MAR-1006	Piroque	30.00
MAR-1007	Response Boat, 24' - 27'	1,350.00
MAR-1012	Barge Boat, 24'-28'	850.00
MAR-1014	Pontoon Boat w/motor	400.00

Containment Boom

		Daily Rate
CBM-1004	Containment Boom, 18"	1.75 ft.
CBM-1006	Containment Boom, 12"	1.25 ft.
CBM-1007	Containment Boom, 42"	4.50 ft
CBM-1005	Mini-Boom.....	1.10 ft.
CBMA-18	Boom Anchor, 18 lb.	45.00
CBMA-22	Boom Anchor, 22 lb.	58.00
CBMA-40	Boom Anchor, 40 lb.	150.00
CBMA-75	Boom Anchor, 65 lb.	252.00
CBMA-100	Boom Anchor, 85 lb.	349.00
CBMA-1012	Boom Lights.....	20.00
CBMA-1013	Anchor buoys/markers.....	20.00
CBMA-1014	Large Boom Magnets	50.00
CBMA-1015	Small Boom Magnets.....	25.00

Skimmers

		Daily Rate
SKIM-1015	Drum Skimmer Double 36" Drum (Does NOT include compressor).....	800.00
SKIM-1002-70	Drum Skimmer, 36" Drum (Does NOT include compressor)	600.00
SKIM-NO-1003-20	Drum Skimmer, 24" Drum (Does NOT include compressor)	450.00
SKIM-1006	Skimmer, Acme Mdl 39-T, Vacuum / or Douglas Engineering Skim Pak	150.00
SKIM-1008	Skimmer, Marco, "Harbor 28"	5,000.00
SKIM-1009	Skimmer, Marco, "Sidewinder 14" (Includes power pack)	4,200.00
SKIM-1010	Oleophilic Pad Replacement, Marco Skimmer	Cost Plus 20%
SKIM-1012	RF Weir Skimmer	500.00
SKIM-1013	VSP Screw Pump Skimmer	1,800.00
SKIM-1001	Disk Oil Skimmer (Includes power pack)	3,250.00

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Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Sorbent Material

		Unit Rate
GES-CLAYSORB	Floor Dry Clay Based Absorbent	11.00
GES-CLEANBEE	Clean B	32.00
GES-B510	Boom, Sorbent, 5"	105.00
GES-B810	Boom, Sorbent, 8"	180.50
GES-UB510	Boom, Sorbent, Universal, 5"	134.05
GES-UB810	Boom, Sorbent, Universal, 8"	180.00
GES-EX-SORB	Peat Moss Sorbent, 2 cf x 20 lb bag	39.25
GES-GS-22	Floor Gator, Granular, 50 lb bag	26.95
GES-IR300	Industrial Rug, Sorbent, 36" x 300'	278.30
GES-GATOR030	Oil Gator, 30 lb bag	45.05
GES-P100	Pad, Sorbent, 100 pad bale	90.00
GES-P200	Pad, Sorbent, 200 pad bale	95.00
GES-UQ100	Pad, Sorbent, Universal, Gray, 17" x 19" x 3/8", 100 pad bale	104.60
GES-R144	Roll, Sorbent, 1 roll bale	144.30
GES-OS15	Snare, Viscous Oil,	60.00
GES-OSB50	Snare Boom, Viscous Oil, 50'	73.75
GES-OSB100	Snare Boom, Viscous Oil, 100'	186.50
GES-OD40	Sorbent, All-Purpose, Oil-Dry	12.90
GES-SPHAGSORB2	Sphag Sorb, 2 cf x 24 lb bag	42.25
GES-SW100	Sweep, Sorbent, 1 sweep bale	110.60
GES-2950	Zorbent, Absorbent Material	62.50
GES-OILHAWG	Oil Hawg	30.00/Per Bag

Pumps and Hoses

		Daily Rate
PUMP-1000	DC Pump, on Dolly	100.00
PUMP-1001	Pump, 1" Poly Diaphragm/Stainless	100.00
PUMP-1004	Pump, 2"	90.00
PUMP-1002	Pump, 2" Blackmere Vane, (Hydraulic)	200.00
PUMP-1003	Pump, 2" Diaphragm	90.00
PUMP-1006	Pump, 2" Stainless Steel Diaphragm	250.00
PUMP-1010	Pump, 3" Diaphragm	100.00
PUMP-1009	Pump, 3" Diaphragm, Diesel	100.00
PUMP-1011	Rebuild Kit, Diaphragm Pump	500.00 Each
PUMP-1013	Pump, 3" Diaphragm, Stainless	150.00
PUMP-1014	Pump, Hand Plastic	25.00 Each
PUMP-1008	Pump, Wash (with suction & discharge hose & nozzle)	90.00
MSE-1038	Hose, Chemical Resistant, 3" x 20'	20.00
MSE-1037	Hose, Chemical Resistant, 2" x 20'	20.00
MSE-1051	Hose, Chemical Resistant, 1" x 10'	20.00
MSE-1039	Hose, Chemical Resistant, Hard Gum Rubber, 6" x 25'	28.00
MSE-1040	Hose, Fire, 50' section	50.00
MSE-1041	Hose, Metal, Flex, 6" x 25'	25.00
MSE-1042	Hose, Solid Metal, Joint Pipe, 6" x 12'	22.00
MSE-1043	Hose, Suction/Discharge, 2" x 25'	8.00
MSE-1044	Hose, Suction/Discharge, 3" x 20'	8.00
MSE-1047	Hose, ADS 6"	1.75 Foot
MSE-1052	Hose, Air 1" x 50'	40.00
MSE-1053	Hose, Air 3/4" x 50'	40.00
MSE-1054	Hose, Industrial/water	40.00

Specialty Equipment

		Daily Rate
MSE-1062	SP-30, 3"/6" Submersible Pump with Crane and Jetter Head	175.00/hr.
MSE-1063	Hose, 6" x 50'	24.00/day
MSE-1064	Hose, 6" x 20'	12.00/day

All rates listed in this schedule are subject to change without notice.

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Specialty Equipment - Continued

		Daily Rate
MSE-1065	Hose, 3" x 50'	24.00/day
MSE-1066	Hose, 3" x 20'	12.00/day
MSE-1067	Rotomite 180P Dredge	1,800.00/day

Communications Equipment

		Daily Rate
COMM-1001	Cellular Telephone (Each)	25.00
COMM-1002	Computer, Laptop/Desktop w/Printer.....	125.00
COMM-1004	GPS, Hand Held	25.00

(NOTE: Any items not returned to the Command Unit upon completion of work will be charged back to the customer at cost plus 20%.)

Haz-Mat Equipment

		Daily Rate
MSE-1005	Betz Emergency Off-Loading Valve.....	500.00
HMS-1003	Chlorine Emergency Kit "A"	500.00
HMS-1004	Chlorine Emergency Kit "B"	750.00
HMS-1005	Chlorine Emergency Kit "C"	1,000.00
HME-1005	Vacuum Cleaner, Stainless Steel, Mercury, HEPA	250.00
HMS-1001	Cylinder Refill, Nitrogen, Each	50.00
MSE-1018	Decontamination Kit (Pool, Brush, Bucket, Soap), Each	50.00
MSE-1060	Dome Lid Clamps	100.00

Miscellaneous Equipment

		Daily Rate
MSE-1004	Back-Pack Blower.....	30.00
MSE-1006	Camera, Digital.....	50.00
MSE-1068	Formal Job Report with photos (max. 27 exposures)	150.00
MSE-1006-1	Photo-Processing, Each Frame.....	2.50
MSE-1009	Chain Saw	75.00
MSE-1049	Compressor, Air, 11.8 cfm, 90 psi output + fuel (GES Owned)	185.00
MSE-1048	Drum Crusher	250.00
MSE-1013	Drum Dolly	25.00
MSE-1015	Drum, Grabber Forklift.....	100.00
MSE-1016	Drum Pump, Poly.....	25.00
MSE-1017	Drum Sling.....	25.00
MSE-1050	Eye Wash Station	35.00
MSE-1020	Generator, 4 kw	100.00
MSE-1046	Hand Tool (Pitch Fork, Rake, Shovel, Squeegee, etc).....	17.00
MSE-1023	Power Pack, Hydraulic, 50 hp or less	500.00
MSE-1026	Saw, Air Powered	75.00
MSE-1027	Saw, Portable	75.00
MSE-1028	Scare Cannon plus Fuel	60.00
MSE-1029	Sewer Plug	100.00
MSE-1030	Sprayer, Pump, Hand-Held.....	30.00
MSE-1001	Stainless Steel Stinger, 2"	50.00
MSE-1032	Vacuum Cleaner, Wet/Dry	50.00
MSE-1034	Weed Eater, Commercial.....	120.00
MSE-1035	Wheelbarrow.....	25.00
MSE-1056	Ladder (straight, Rope, Folding).....	25.00
MSE-1057	Ladder (Extension)	35.00
MSE-1058	Chemical, Tape Roll	35.00
MSE-1061	Pallet Jack	50.00
MSE-1024	Pressure Washer	300.00
MSE-1069	20' x 30' Drash style tent w/floor.....	250.00
MSE-1070	20' x 40' Drash style tent w/o floor or doors.....	300.00
MSE-1071	12 Ton air conditioning system for Drash style tents (plus fuel)	900.00

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Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Monitoring Equipment

		Daily Rate
MTE-1001	4-Gas Meters	95.00
MTE-1002	5-Gas Meters	125.00
MTE-1006	Black Light, Mercury Detection	40.00
MTE-1007	Crowcon Monitor, 5 gas	150.00
MTE-1008	Drager CMS Unit	300.00
MTE-1015	Colorimetric Tube Hand Pump	30.00
MTE-1041	Benzene Tubes.....	11.00 Each
MTE-1043	VOC Tubes	11.00 Each
MTE-1034	FID Detector, Handheld	200.00
MTE-1037	FID Detector Hydrogen Refill.....	100.00
MTE-1009	Infrared Thermometer.....	50.00
MTE-1020	Intrinsically Safe Thermometer (laser).....	15.00
MTE-1003	Jerome Mercury Vapor Analyzer	175.00
MTE-1011	ph Meter.....	30.00
MTE-1039	Ph Strips Box	25.00
MTE-1012	Photoionization Detector (PID), MiniRae	75.00
MTE-1036	Photoionization Detector, Ultra (PID), Ultra MiniRae	100.00
MTE-1010	Radiation Monitor.....	75.00
MTE-1023	Chemsticks	15.00
PPE-1035	Smart Strips	35.00
MTE-1024	Coconut Charcoal VOC Sampling Tubes	5.00
MTE-1030	Single Calibration Gas – One (1) Calibration.....	20.00
MTE-1031	Quad Gas Calibration Gas – One (1) Calibration	25.00
MTE-1032	Tedlar Bag w/Stainless Fittings – 1 Liter	26.00
MTE-1033	Tedlar Bag w/Stainless Fittings – 5 Liter	40.00
MTE-1040	Hamby Soil Sampling Test	45.00 Each
MTE-1042	HCL Monitor.....	150.00

Rescue Equipment

		Daily Rate
MSE-1012	Confined Space Rescue Kit.....	125.00
MSE-1045	Coppus Blower	50.00
MSE-1059	Air Horn 6"	25.00
PPE-1020	Harness, Safety, w/lanyard.....	35.00
PPE-1030	Safety Lifeline	25.00
PPE-1036	Retrieval, System Tripod	95.00
PPE-1037	Replacement of Equipment	CostPlus20%

Personal Protective Equipment

		Daily Rate
PPE-1005	Bunker Gear (Pants, Coat, Gloves, Helmet, Boots)	250.00
PPE-1006	Chest Waders	50.00
PPE-1007	Cool Vest	50.00
PPE-1008	Coveralls, Poly-Coated Tyvek Hood and Boots, Each	16.00
PPE-1009	Coveralls, Saranex, Each	18.00
PPE-1010	Coveralls, Tyvek, Each	10.00
PPE-1021	Level A, Responder, Each	1,150.00
PPE-1022	Level B, Fully-Encapsulated (CPF 4) Each	225.00
PPE-1024	(CPF 3), Each	105.00
PPE-1026	(CPF 2), Each	65.00
PPE-1027	(CPF 1), Each	50.00
PPE-1034	Level D, PPE, Each	45.00
PPE-1033	Slicker Suit, Rain, Each	25.00
PPE-1038	Suit, Acid Each	47.50
PPE-1045	Road Safety Vest.....	5.00

All rates listed in this schedule are subject to change without notice.

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Personal Protective Equipment - Continued

		Daily Rate
PPE-1046	Life Jacket	10.00
PPE-1044	Safety Goggles/Glasses	3.00

Boots

		Unit Rate
PPE-1001	Boot, Tingley, Pair	130.00
PPE-1002	Boot, Chemical, NFPA Approved, Pair	90.00
PPE-1003	Boot, Rubber, Steel-toe, Pair	45.00
PPE-1004	Booties, Latex, Pair	7.00

Gloves

		Unit Rate
PPE-1011	Glove, Latex, Sample, Pair	1.00
PPE-1012	Glove, Leather, Pair	5.95
PPE-1013	Glove, Neoprene, Pair	5.95
PPE-1029	Glove, Nitrile, Inner, Pair	1.00
PPE-1015	Glove, Nitrile, Outer, Pair	3.75
PPE-1017	Glove, "Black Knight", (PVC) Pair	3.25
PPE-1018	Glove, "Silver Shield", Pair	8.00
PPE-1019	Glove, Liner, Cotton, Pair	1.00
PPE-1039	Glove, Butyl	25.00
PPE-1040	Glove, Viton	75.00
PPE-1041	Glove, Natural Rubber	3.00

Respiratory Protection

		Unit Rate
HME-1001	Air Regulator	50.00/day
HME-1002	Breathing Air Cylinder	10.00/day
HME-1011	Breathing Air Hose, 50' Section	12.00/day
HME-1003	Escape Mask	50.00/day
HME-1004	Escape Pack	125.00/day
HME-1007	Full-Face Respirator (includes first Cartridge set)	50.00/day
HME-1008	Half-Face Respirator (Organic Mask, Disposable), Each	29.00
HME-1009	Self-Contained Breathing Apparatus (SCBA)	125.00/day
HME-1010	Half-Face Respirator w/o cartridges, Each	12.50
HME-1009-RF	Self-Contained Breathing Apparatus (SCBA) Refill	25.00
PPE-1028	Respirator Cartridge, HEPA, Each	7.50
PPE-1031	Respirator Cartridge, HEPA/OV/AG, Pair	24.00
PPE-1032	Respirator Cartridge, Mercury Vapor, Pair	30.00
PPE-1042	Cart, Air w/two Air Cylinder	75.00/day
PPE-1043	Breathing Air Cylinder Refill	Cost Plus 20%

Sampling and Testing Equipment and Supplies

		Unit Rate
ST-1003	Drum Thief Sampling Tubes	16.00
ST-1004	Haz-Cat Sampling Kit, per test	35.00
ST-1017	Hydrocarbon Test Kit	47.65
ST-1007	Mercury Test Kit	225.00
ST-1008	PCB Wipe Test Kit	30.00
ST-1009	Personnel Sampling Pump	50.00
ST-1010	Pipettes, Glass	2.00
ST-1011	pH Paper (Roll or Box)	20.00
ST-1013	Sample Bomb	120.00
ST-1014	Sample Jars	5.00
ST-1015	Sample Storage	15.00

All rates listed in this schedule are subject to change without notice.

Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Sampling and Testing Equipment and Supplies - Continued

		Unit Rate
ST-1016	Soil Sampling Kit.....	35.00
ST-1018	Shippers, Sample Jar (plus postage).....	50.00
ST-1006	Lab Analysis, Accredited Third Party.....	Cost Plus 20%
ST-1019	Waste Disposal – Profile Charge	150.00

Storage

		Daily Rate
STR-1009	Tote, Poly, 300 gl.....	25.00
STR-1010	Tote, Poly, 300 gl Replacement Each	350.00
MSS-1008	Box Liner, Roll-Off Box	50.00
MSS-1012	Drum Liner, Plastic Bag, 55 gl x 6 ml, Each	2.00
MSS-1011	Drum Liner, Plastic Bag, 55 gl x 6 ml, 50 per roll.....	90.00
GES-LP5	Drum, Poly, 5 gl, w/lid	16.10
GES-LP20SL	Drum, Poly, O/H 20 gl w/screw-on lid	62.50
GES-PDOH30	Drum, Poly, 30 gl, w/lid	55.00
GES-PDOH25	Drum, Poly, O/H, Nestable, 25 gl.....	58.30
GES-PDOH55	Drum, Poly, O/H, w/fittings, 55 gl.....	70.00
GES-PDOHN30	Drum, Poly, O/H, Nestable, w/fittings, 30 gl.....	65.00
GES-PDOHN55	Drum, Poly, O/H, Nestable, w/fittings, 55 gl.....	70.00
GES-PDTH55	Drum, Poly, T/H, w/bungs, 55 gl	75.00
GES-OP95	Drum, Poly, Overpack, 95 gl.....	200.00
GES-OP95M	Drum, Poly, Overpack, 95 gl, Metric.....	327.50
GES-OP110	Drum, Poly, Overpack, 110 gl.....	350.00
GES-CTSD55	Drum, Steel, T/H, 55 gl	65.00
GES-OTSD55	Drum, Steel, O/H, 55 gl.....	65.00
GES-SOP85	Drum, Steel, Overpack, 85 gl.....	175.00
GES-SOP110	Drum, Steel, Overpack, 110 gl.....	670.30
GES-DRUMLABELS	Drum Labels	1.00/Each

Chemicals

		Unit Rate
GES-ACETIC-5	Acetic Acid, Glacial, 5 gl pail.....	87.35
GES-ACETIC-GL-55	Acetic Acid, Glacial, 55 gl. Drum	528.75
GES-ACETIC-56PCT-55	Acetic Acid, Industrial Grade, 56% pure, 55 gl drum	450.00
GES-ACIDIC-5	Acetic Acid, 5 gl	82.50
GES-BA50	Boric Acid, 5%, 50 lb bag.....	96.55
GES-BCC#1-250	Petro-Clean, Spill Control Liquid, 250 gl tote.....	9,375.00
GES-BCC#1-300	Petro-Clean, Spill Control Liquid, 300 gl tote.....	11,250.00
GES-BCC#1-5	Petro-Clean, Spill Control Liquid, 5 gl pail	200.65
GES-BCC1-55	Petro-Clean, Spill Control Liquid, 55 gl drum.....	2,062.50
GES-BRAT-A+	A+ Microbes, 1 lb	57.50
GES-BRAT-B	B Microbes, 1 lb	57.50
GES-BRAT-Z	Z Microbes, 1 lb	57.50
GES-CITRIC50B	Citric Acid, 50%, Grade B, 575 lb drum	1,048.40
GES-DGR1	Degreaser/Solvent, 1 gl container	46.35
GES-DRYBSTR	Dry Booster, 1 lb	57.50
GES-MBELSC250	Micro-Blaze, Emergency Liquid Spill Control, 250 gl tote.....	10,758.50
GES-MBELSC5	Micro-Blaze, Emergency Liquid Spill Control, 5 gl bucket	132.50
GES-MBOL5	Micro-Blaze Out, Firefighting Agent, 5 gl pail	215.15
GES-PES-51-1	PES-51, Organic Bio-Cleanser, Oil Release Agent, 1gal container	84.00
GES-PES-51-5	PES-51, Organic Bio-Cleanser, Oil Release Agent, 5 gal bucket.....	420.00
GES-PES-51	PES-51, Organic Bio-Cleanser, Oil Release Agent, 55 gal drum	4,470.50
GES-TEGRASOLVEH-55	Tegra, Solve H, 55 gl drum.....	1,760.00
GES-SA50D	Soda Ash, Dense, 50 lb bag	42.80
GES-SB50	Sodium Bicarbonate, 50 lb bag.....	39.20

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Corporate	Response Rate Schedule Domestic	Schedule
Operations		Rev. June 2011

Chemicals - Continued

		Unit Rate
GES-SODHCH	Sodium Hypochlorite, Liquid, 1 gl	2.10
GES-AMM	Ammonia.....	2.50 gal
GES-BLEACH	Bleach.....	2.50 gal
GES-ECOSORB	Ecosorb (Mercapthan Neutralization)	80.00 gal
GES-REAGENT	Reagent, Miscellaneous	CostPlus20%

Miscellaneous Material

		Unit Rate
MSM-1001	Diesel Fuel.....	Current Price
MSM-1002	Gasoline.....	Current Price
MSM-1003	A Fuel Surcharge of 17% of the hourly/ Daily Equipment /Vehicle rate will be charged on all Motorized Equipment.	
MSS-1002	Barricade Tape, Roll each	23.10
MSS-1001	Duct Tape, 2" x 60 yd each.....	9.10
MSS-1009	Epoxy Stick, Sealant each	12.00
MSS-1010	Heat Stress Relief Supplies	15.00
MSS-1003	Rags/Wipes, Colored, 50 lb box each	52.50
GES-CR25	Rope, Cotton, 1/4" x 100' each	25.00
MSS-1006	Rope, Polypro, 1/2" x 600' each	75.00
MSS-1007	Rope, Polypro, 1/4" x 600' each	40.00
MSS-1005	Visquine Sheeting, 20' x 100' x 6 ml each	110.00
MSS-1015	Air Tools.....	50.00 Day
MSS-1019	Portable Heaters, Each.....	15.00
MSS-1022	Break Area (tent, bench, chairs, ice chest) Day	125.00
MSS-1023	Face Shield with Bracket	35.00
MSS-1025	Grounding Kit.....	50.00
MSS-1027	Traffic Safety Cone (Each)	8.50

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GARNER ENVIRONMENTAL SERVICES, INC.
1717 West 13th Street
Deer Park, Texas 77536
Telephone: (281) 930-1200
Fax: (281) 478-0296

RESPONSE EQUIPMENT LISTING

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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BOOM TYPE CODE		END CONNECTOR CODE	
F	Fence	ASTM	ASTM Std (D962-86)
FR	Fire	BOLT	Bolt Connector
PI	Inflatable (Press)	HP	Hinge & Pin
SI	Inflatable (Self)	Z	Quick-Connect Z
MR	Marsh (Upper air chamber with lower water chamber)	RC	Raised Channel
R	Round	SNAV	Slide (US Navy)
SB	Weir Boom	SLOT	Slotted Tube
OT	Other	US1	Universal Slide Type 1
		US2	Universal Slide Type 2
		OT	Other

BOOM EQUIPMENT									
Name of Manufacturer	Model Number	Boom Type Code	Invent Length (feet)	Skirt Size (in.)	Float Size (in.)	End Connector Type Code	Time to Deploy	Storage Location	Owner
Acme Products Co.	OK CORRAL	R	13,330	12	6	Z	6.0	Deer Park	Garner
Acme Products Co.	SUPER-MINI	R	350	4	2.5	BOLT	2.0	Deer Park	Garner
Acme Products Co.	OK CORRAL	R	16,900	12	6	Z	6.0	La Marque	Garner
Acme Products Co.	OK CORRAL	R	5,000	12	6	Z	2.5	Port Arthur	Garner
Acme Products Co.	SUPER-MINI	R	100	4	2.5	BOLT	0.5	Port Arthur	Garner
Acme Products Co.	OK CORRAL	R	34,000	12	6	Z	6.0	Port Arthur	Garner

Corporate	Response Equipment Listing	Equipment Listing
Operations		June 2011

COMMUNICATIONS TYPE CODES			
AF	Aviation Frequency	MF	Marine Frequency
CP	Cellular Phone	PAG	Pager
COM	Command Post	PHH	Portable Hand Held
MOD	Computer w/modem	SSB	Single Side Band
FAX	Facsimile	TP	Telephone
FBS	Fixed Base Station	OT	Other

COMMUNICATIONS EQUIPMENT										
Name of Manufacturer	Model Number	Comm Type	Nr. of Units	Frequency	Band	Range (miles)	Field Tunable		Storage Location	Owner
							Yes	No		
40' Garner Command Post		COM	1					X	Deer Park	Garner
26' Communications Trailer	MCC1	COM	1	931.462			X		Deer Park	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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RESPONSE VEHICLES

Name of Manufacturer	Response Vehicle	Number of Units	Wide Load Permit Needed		Storage Location	Owner
			Yes	No		
Wabash	48' Box Vans, Sorbent Boom Trailers	2		X	Deer Park	Garner
Fruehauf	48' Box Van, Sorbent Boom Trailer	1		X	Deer Park	Garner
Ford/Chevy	Pick-up Truck, 1 ton	20		X	Deer Park	Garner
Sooner	Emergency Response Trailer, 32'	3		X	Deer Park	Garner
Modern Mfg.	Boom Trailer, 20' Gooseneck	4		X	Deer Park	Garner
Ford/Chevy	Pick-up Truck, 1 ton (2 Deer Park & 4 Port Arthur)	6		X	Deer Park / Port Arthur	Garner
Ford/Chevy	Pick-up Truck, 1 ton	14		X	La Marque	Garner
Sooner	Emergency Response Trailer, 32'	1		X	La Marque	Garner
Modern Mfg.	Boom Trailer, 20' Gooseneck	3		X	La Marque	Garner
Iron Horse	Boom Trailer, 20 Gooseneck	3		X	La Marque	Garner
Modern Mfg.	Spill Trailer, 16' Lo-Boy	4		X	La Marque	Garner
Modern Mfg.	Haz-Mat Spill Trailer, 20'	2		X	La Marque	Garner
Ford	Pick-up Truck, 1 ton	7		X	Port Arthur	Garner
Sooner	Emergency Response Trailer, 32"	1		X	Port Arthur	Garner
Modern Mfg.	Trailer, Spill Response, 16' Lo-Boy	1		X	Port Arthur	Garner
Modern Mfg.	Boom Trailer, Gooseneck, 20'	3		X	Port Arthur	Garner
Gemini Cargo	Trailer, Haz-Mat, 19'	1		X	Port Arthur	Garner
Modern Mfg.	Spill Trailer, 20' Lo-Boy	2		X	Port Arthur	Garner
Modern Mfg.	Boom Trailer, Gooseneck, 20'	2		X	Port Arthur	Garner
Great Dane	53' Box Van, Hard Boom	3		x	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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BOOM EQUIPMENT

Name of Manufacturer	Model Number	Equipment Type	Quantity	Storage Location	Owner
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	13	Deer Park	Garner
Polycord	600x1/4	Rope, Polypropylene, 1/4" x 600'	3	Deer Park	Garner
Polycord	600x1/2	Rope, Polypropylene, 1/2" x 600'	5	Deer Park	Garner
Polycord	600x3/8	Rope, Polypropylene, 3/8" x 600'	1	Deer Park	Garner
U.S. Anchor Mfg., Inc.	22#	Anchor, Galvanized Steel, 22 lb., Danforth Style	0	Deer Park	Garner
U.S. Anchor Mfg., Inc.	40#	Anchor, Galvanized Steel, 40 lb., Danforth Style	0	Deer Park	Garner
U.S. Anchor Mfg., Inc.	75#	Anchor, Galvanized Steel, 75 lb., Danforth Style	4	Deer Park	Garner
U.S. Anchor Mfg. Inc.	100#	Anchor, Galvanized Steel, 100 Lb. Danforth Style	13	Deer Park	Garner
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	20	Deer Park	Garner
Polycord	600 x1/4	Rope Polypropylene, 1/4" x 600'	3	Deer Park	Garner
Polycord	600 x 1/2	Rope Polypropylene, 1/2 " x 600'	1	Deer Park	Ganrer
U.S. Anchor Mfg., Inc.	22 #	Anchor, Galvanized Steel, 18 lb., Danforth Style	0	Deer Park	Garner
U.S. Anchor Mfg., Inc.	40 #	Anchor, Galvanized Steel, 22 lb., Danforth Style	0	Deer Park	Garner
U.S. Anchor Mfg. Inc.	100 #	Anchor, Galvanized Steel, 100 #, Danforth Style	13	Deer Park	Ganrer
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	2	La Marque	Garner
Polycord	600 x1/4	Rope Polypropylene, 1/4" x 600'	5	La Marque	Garner
Polycord	600 x 1/2	Rope Polypropylene, 1/2 " x 600'	5	La Marque	Garner
U.S. Anchor Mfg., Inc.	22#	Anchor, Galvanized Steel, 22 lb., Danforth Style	8	La Marque	Garner
U.S. Anchor Mfg., Inc.	40#	Anchor, Galvanized Steel, 40 lb., Danforth Style	5	La Marque	Garner
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	8	Port Arthur	Garner
Polycord	600 x 1/4	Rope Polypropylene 1/4 " x 600 '	5	Port Arthur	Garner
Polycord	600 x 1/2	Rope Polypropylene 1/2 " x 600'	5	Port Arthur	Garner
U.S. Anchor Mfg., Inc.	22 #	Anchor, Galvanized Steel, 22 lb., Danforth Style	12	Port Arthur	Garner
U.S. Anchor Mfg., Inc.	75#	Anchor, Galvanized Steel, 75 lb., Danforth Style	6	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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AIR MONITORING EQUIPMENT

Name of Manufacturer	Miscellaneous Equipment	Number of Units	Storage Location	Owner
Rae Systems	Mini RAE 2000	1	Deer Park	Garner
Airzona Instruments	Jerome X431	3	Deer Park	Garner
Ludlum	Model # 3	1	Deer Park	Garner
BW	Gas Alert Micro 5 PID	2	Deer Park	Garner
BW	4 Gas	6	Deer Park	Garner
BW	Gas Alert Micro 5	4	Deer Park	Garner
Ludlum	2241-2 Radiation Monitor	1	Deer Park	Garner
Sper Scientific	PH Meter	1	Deer Park	Garner
Dexsil	PetroFlag Hydrocarbon Test Kit	1	Deer Park	Garner
Chlorine	AC/ Kit	1	Deer Park	Garner
Rae	Mini Rae	4	La Marque	Garner
BW	Micro 5	4	La Marque	Garner
Rae	Ultra	4	La Marque	Garner
BW	4 Gas	1	La Marque	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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	Specialty Equipment			
Name of Manufacturer		Number of Units	Storage Location	Owner
Scott	Self Contained Breathing Apparatus(SCBA) with 12 extra bottles / Scott	12	Deer Park	Garner
	Bezt Valve / Off Loading Valve	2	Deer Park	Garner
	Chorine Emergency Kit A	1	Deer Park	Garner
	Chorine Emergency Kit B	1	Deer Park	Garner
	Chorine Emergency Kit C	1	Deer Park	Garner
	Vacuum Cleaner / Stainless Steel, Mercury, HEPA	3	Deer Park	Garner
	Cameras / Digital	10	Deer Park	Garner
	Confine Space Rescue Kits	2	Deer Park	Garner
	Coppus Blowers	2	Deer Park	Garner
	Air Compressors 11.8 cfm 90 psi	6	Deer Park	Garner
	Drum Crushers / Diesel Power	1	Deer Park	Garner
	Drum Crabber	5	Deer Park	Garner
	Generators	0	Deer Park	Garner
	Decontamination Pools 20" x 100'	2	Deer Park	Garner
	Fan, Ventilation 48'	3	Deer Park	Garner
	Artic Cat, Four Wheeler	2	Deer Park	Garner
	Light Stands	5	Deer Park	Garner
	Air Compressors (Portable)	5	La Marque	Garner
	HEPA Vacuums	0	La Marque	Garner
	Cameras / Digital	2	La Marque	Garner
	Artic Cat, Four Wheeler	2	La Marque	Garner
	Generators	4	La Marque	Garner
	Scare Guns	3	Port Arthur	Garner
	Self Contain Breathing Apparatus (SCBA)	10	Port Arthur	Garner
	Cameras / Digital	1	Port Arthur	Garner
	Chlorine Emergency Kit "C"	1	Deer Park	Garner
	Midland Kit	1	Deer Park	Garner
	Railcar Haz Hammock	1	Deer Park	Garner
	Mercury Vacuum	3	Deer Park	Garner
	Carbon Filter Systems	1	Deer Park	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing		
		June 2011		

	Specialty Equipment / Continued			
	Wet & Dry Vacuum with HEPA Filter	1	Deer Park	Garner
	100 Watt Explosion Proof Light Sets	2	Deer Park	Garner
	Decon Pools 4' x4' x14' 5"	2	Deer Park	Garner
	Spill Guard 6' x 4' x8"	1	Deer Park	Garner
	Drum Dolly	4	Deer Park	Garner
	3/4 " Core Sampler	1	Deer Park	Garner
	Soil Sampler (boring) Kit	1	Deer Park	Garner
	Self Contained Breathing Apparatus (SCBA)	9	Deer Park	Garner
	Generators (Portable)	0	Deer Park	Garner
	Weed Eaters	2	Deer Park	Garner
	Air Compressors (Portable)	9	Deer Park	Garner
	Light Stand (Portable)	10	Deer Park	Garner
	Coppus Blower	1	Deer Park	Garner
	Chain Saw	3	Deer Park	Garner
	Tank Truck Emergency Transfer Valve	1	Deer Park	Garner
	Air Horn, 6"	1	Deer Park	Garner
	Fan Ventilation, 48"	1	Deer Park	Garner
	Fan Ventilation, 16" Port A Cool with water Mister	1	Deer Park	Garner
	Digital Cameras	4	Deer Park	Garner
	Coppus Blowers	1	Port Arthur	Garner
	Air Compressors	3	Port Arthur	Garner
	Scare Guns	4	Port Arthur	Garner
	Pressure Washers	0	Port Arthur	Garner
	Weed Eaters	1	Port Arthur	Garner
	Artic Cat , Four Wheeler	1	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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A	Auger/Screw	D	Diesel
C	Fire	E	Electric
P	Parastolic	G	Gasoline
R	Reciprocating	H	Hydraulic
I	Rotary/Flexible impeller	P	Pneumatic
OT	Other	OT	Other

PUMP EQUIPMENT								
Name of Manufacturer	Model Number	Pump Type Code	Drive Type Code	Suction/ Discharge Size (inches)	Mfg. Pump Rate (gpm)	Quantity	Storage Location	Owner
Aro/Ingersoll Rand	KO176-44	P	P	1.0	120	2	Deer Park	Garner
Honda	WXT-20	G	I	2.0	180	15	Deer Park	Garner
Yanmar	LD-40/2	D	I	2.0	180	2	Deer Park	Garner
Honda	WXT-30	G	I	3.0	275	1	Deer Park	Garner
Wilden	Model M	P	P	3.0	240	5	Deer Park	Garner
Versa-Matic		OT	P	2.0	140	1	Deer Park	Garner
Versa-Matic		OT	P	1.5	140	1	Deer Park	Garner
Honda	EPT2	G	I	3.0	275	1	Deer Park	Garner
Wisconsin/Multi Quip		D	I	3.0	185	1	Deer Park	Garner
Yamada	POLY	P	P	3.0	200	1	Deer Park	Garner
Various		D	I	2.0	200	5	Deer Park	Garner
Various		G	I	2.0	190	2	Deer Park	Garner
Versamatic	STAINLESS	P	P	2.0	140	2	Deer Park	Garner
Honda	WXT-20	G	I	2.0	180	1	La Marque	Garner
Yanmar	LD-40/2	D	I	2.0	180	5	La Marque	Garner
Wilden	Model M	OT	P	3.0	240	0	La Marque	Garner
Acme Products Co., Inc.	FS-150A	G	I	1.5	275	1	Port Arthur	Garner
Honda	WXT-20	G	I	2.0	180	6	Port Arthur	Garner
Yanmar	LD-40/3	D	I	2.0	200	2	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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RESPONSE BOAT TYPE CODES		TRANSPORTATION METHOD CODES	
BAY	Bay Waters	NT	Normal Trailer
JB	Jon Boat	WO	Water Only
LFB	Large Flat Bottom	WL	Wide load Trailer
OFF	Offshore	OT	Other
PRO	Protected Waters		
TC	Towing Capable		
OT	Other		

RESPONSE BOATS

Name of Manufacturer	Model Number	Boat Type Code	Horse Power	Normal Crew Size	Length / Beam	Draft Limit	Number of Boats	Transport Method Code	Storage Location	Owner
Alumacraft	12	PRO	0	1	12	1'	2	NT	Deer Park	Garner
Custom Flat	1650	JB	25	2	16'	1'	7	NT	Deer Park	Garner
Custom Flat	20	LFB	40	2	20' / 6'	2'	1	NT	Deer Park	Garner
Custom Build	30	BAY	300	3	30' / 8'	2'	1	NT	Deer Park	Garner
Silver Ships	30'	BAY	450	3	30' / 8'	2	1	NT	Deer Park	Garner
Pirogue	12'	OT	0	1	12' / 2"	3"	2	NT	Deer Park	Garner
Various	12'	JB	25	1	12' / 3"	1'	2	NT	Deer Park	Garner
Scully	28'	BAY	230	2	28' / 8'	8"	1	NT	Deer Park	Garner
Alumaweld	1650	JB	25	3	16' / 6'	1'	4	NT	La Marque	Garner
Custom Boat Mfg.	1649R	JB	30	2	16' / 6'	2'	1	NT	La Marque	Garner
Broadhead	24	BAY	150	3	24' / 8'	2'	1	NT	La Marque	Garner
Alumaweld	1650	JB	25	2	16' / 6'	1'	5	NT	Port Arthur	Garner
Alumaweld	20	BAY	40	2	20' / 0'	2'	1	NT	Port Arthur	Garner
Alumaweld	1450	JB	25	2	14' / 0"	2"	1	NT	Port Arthur	Garner
Lobell	28'	BAY	200	3	28' / 8'	2'	1	NT	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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SKIMMER TYPE CODES

FS	Floating Suction	HIP	Hydrodynamic Inclined Plane
IV	Induced Vortex	OB	Oleophilic Belt
OD	Oleophilic Disk	OR	Oleophilic Rod
PW	Paddle-Wheel	SK	Sock
W	Weir	OT	Other

SKIMMER EQUIPMENT

Name of Manufacturer	Model Number	Skimmer Type Code	Number of Units	Mfg. Recovery Rate (gpm)	Hose Size Suction/Discharge (inches)	Time to Deploy	Storage Location	Owner
Acme Products Co., Inc.	FS400ASK-39T	W	3	275	3.0	1.5	Deer Park	Garner
Douglas Engineering	4200SH Skim-Pak	FS	2	5 - 68	2.0	5	Deer Park	Garner
Crucial Inc.	1D18P-23	OT	2	25	2.0	.5	Deer Park	Garner
Crucial Inc.	1D18P-36	OT	5	36	2.0	.5	Deer Park	Garner
Crucial Inc.	VSP-3"	W	2	550	3.0	1.5	Deer Park	Garner
Crucial Inc.	RF-Floating Head	W	1	200	3.0	1	Deer Park	Garner
Douglas Engineering	4200SH Skim-Pak	FS	2	5 - 68	2.0	.5	Deer Park	Garner
Marco	Sidewinder 14	OB	3	70	3.0	.5	Deer Park	Garner
Marco	Harbor 28	OB	1	70	2.0	.5	Deer Park	Garner
Elastec	Mini Max, 20"	OT	1	20	2.0	1.	Deer Park	Garner
Acme Products Co., Inc.	FS400ASK-39T	W	1	275	3.0	1.0	La Marque	Garner
Crucial Inc.	1D18P-23	OT	3	25	2.0	.5	La Marque	Garner
Acme Products Co., Inc.	FS400ASK-39T	W	1	275	3.0	.5	Port Arthur	Garner
Crucial Inc.	1D18P-36	OT	3	25	2.0	.5	Port Arthur	Garner
Elastec	Double Drum	OT	1	60	2.0	.5	Port Arthur	Garner

Corporate	Response Equipment Listing	Equipment Listing
Operations		June 2011

PU	Portable Vacuum Pump	D	Diesel
SS	Units	E	Electric
VT	Super Sucker	G	Gasoline
OT	Vacuum Truck	H	Hydraulic
	Other	P	Pneumatic
		OT	Other

VACUUM SYSTEM EQUIPMENT

Name of Manufacturer	Model Number	System Type Code	Drive Type Code	Suction (inches)	Number of Units	Mfg. Recovery Rate (gpm)	Storage Capacity (gallon)	Hose Invent (feet)	Storage Location	Owner
Safety Vac	449222	OT	D	14	1	40	150	200	Deer Park	Garner
Press Vac International		VT	D	27.0	6	80	3000	200	La Marque	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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SORBENT TYPE CODE		COMPOSITION CODE	
B	Boom	M	Mineral
PAD	Pad	NO	Natural
PT	Particulate	S	Organic
ST	Sheet	OT	Synthetic
SW	Sweep		Other
OT	Other		

SORBENTS										
Name of Manufacturer	Model Number	Sorbent Type Code	Composition Type Code	Normal Inventory	Special Appl. Equip. Needed		Special Rcvg. Equip. Needed		Storage Location	Owner
					Yes	No	Yes	No		
Crucial, Inc.	OS-15	OT	S	1000		X		X	Deer Park	Garner
Complete Environmental Products	GES-P100	PAD	S	120		X		X	Deer Park	Garner
Complete Environmental Products	GES-P200	PAD	S	0		X		X	Deer Park	Garner
Complete Environmental Products	GES-EP100	PAD	S	160		X		X	Deer Park	Garner
Complete Environmental Products	GES-P50	PAD	S	150		X		X	Deer Park	Garner
Complete Environmental Products	GES-B510	B	S	120		X		X	Deer Park	Garner
Complete Environmental Products	GES-B810	B	S	114		X		X	Deer Park	Garner
Complete Environmental Products	GES-R144	ST	S	150		X		X	Deer Park	Garner
Complete Environmental Products	GES-SW100	SW	S	40		X		X	Deer Park	Garner
Complete Environmental Products	GES-PART25	PT	S	10		X		X	Deer Park	Garner
Crucial, Inc.	OS-15	OT	S	10		X		X	La Marque	Garner
Complete Environmental Products	GES-P100	PAD	S	100		X		X	La Marque	Garner
Complete Environmental Products	GES-B510	B	S	20		X		X	La Marque	Garner
Complete Environmental Products	GES-B810	B	S	20		X		X	La Marque	Garner
Complete Environmental Products	GES-R144	ST	S	10		X		X	La Marque	Garner
Complete Environmental Products	GES-SW100	SW	S	30		X		X	La Marque	Garner
Complete Environmental Products	GES-PART25	P	S	40		X		X	La Marque	Garner
Crucial, Inc.	OS-15	OT	S	150		X		X	Port Arthur	Garner
Complete Environmental Products	GES-P100	PAD	S	100		X		X	Port Arthur	Garner
Complete Environmental Products	GES-P200	PAD	S	75		X		X	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing June 2011
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SORBENTS

Name of Manufacturer	Model Number	Sorbent Type Code	Composition Type Code	Normal Inventory	Special Appl. Equip. Needed		Special Rcvg. Equip. Needed		Storage Location	Owner
					Yes	No	Yes	No		
Complete Environmental Products	GES-B510	B	S	100		X		X	Port Arthur	Garner
Complete Environmental Products	GES-R144	ST	S	25		X		X	Port Arthur	Garner
Complete Environmental Products	GES-SW100	SW	S	50		X		X	Port Arthur	Garner
Crucial, Inc.	OS-15	OT	S	250		X		X	Deer Park	Garner
Complete Environmental Products	GES-P100	PAD	S	325		X		X	Deer Park	Garner
Complete Environmental Products	GES-P200	PAD	S	200		X		X	Deer Park	Garner
Complete Environmental Products	GES-EP100	PAD	S	500		X		X	Deer Park	Garner
Complete Environmental Products	GES-B510	B	S	120		X		X	Deer Park	Garner
Complete Environmental Products	GES-B810	B	S	114		X		X	Deer Park	Garner
Complete Environmental Products	GES-R144	ST	S	50		X		X	Deer Park	Garner
Complete Environmental Products	GES-SW100	SW	S	40		X		X	Deer Park	Garner



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

5/3/2012

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER John L. Wortham & Son, L.P. P. O. Box 1388 Houston, TX 77251-1388	CONTACT NAME (HOU) Virginia Brown PHONE (A/C, No, Ext) 713-346-1223 FAX (A/C, No) 713-521-8223 E-MAIL ADDRESS virginia.brown@worthaminsurance.com												
INSURER(S) AFFORDING COVERAGE													
INSURED Garner Environmental Services, Inc. Attn: Mrs Bobbie K. Risner 1717 W. 13th. Street Deer Park TX 77536	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">INSURER A Aspen Specialty Insurance Company</td> <td style="width: 20%; text-align: center;">10717</td> </tr> <tr> <td>INSURER B Liberty Mutual Insurance Company</td> <td style="text-align: center;">23043</td> </tr> <tr> <td>INSURER C</td> <td></td> </tr> <tr> <td>INSURER D</td> <td></td> </tr> <tr> <td>INSURER E</td> <td></td> </tr> <tr> <td>INSURER F</td> <td></td> </tr> </table>	INSURER A Aspen Specialty Insurance Company	10717	INSURER B Liberty Mutual Insurance Company	23043	INSURER C		INSURER D		INSURER E		INSURER F	
INSURER A Aspen Specialty Insurance Company	10717												
INSURER B Liberty Mutual Insurance Company	23043												
INSURER C													
INSURER D													
INSURER E													
INSURER F													

COVERAGES**CERTIFICATE NUMBER:** 13014791**REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	GENERAL LIABILITY <input checked="" type="checkbox"/> COMMERCIAL GENERAL LIAB LITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR _____ GEN'L AGGREGATE L MIT APPL ES PER: <input checked="" type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC			ERA9Y9012	4/21/2012	4/21/2013	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 500,000 MED EXP (Any one person) \$ 5,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000 _____ _____
B	AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> HIRED AUTOS <input checked="" type="checkbox"/> NON-OWNED AUTOS			AS2-641-443542-022	4/21/2012	4/21/2013	COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ _____ BODILY INJURY (Per accident) \$ _____ PROPERTY DAMAGE (Per accident) \$ _____ _____ _____
A	UMBRELLA LIAB <input checked="" type="checkbox"/> OCCUR <input checked="" type="checkbox"/> EXCESS LIAB <input checked="" type="checkbox"/> CLAIMS-MADE <input type="checkbox"/> DED <input type="checkbox"/> RETENTION \$			EXA9Y9212	4/21/2012	4/21/2013	EACH OCCURRENCE \$ 1,000,000 AGGREGATE \$ 1,000,000 _____ _____
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) <input type="checkbox"/> Y <input checked="" type="checkbox"/> N If yes, describe under DESCR PTION OF OPERATIONS below		N/A	WC2-641-443542-012	4/21/2012	4/21/2013	<input checked="" type="checkbox"/> WC STATUTORY L MITS <input type="checkbox"/> OTH-ER E.L. EACH ACCIDENT \$ 1,000,000 E.L. DISEASE - EA EMPLOYEE \$ 1,000,000 E.L. DISEASE - POLICY L MIT \$ 1,000,000
A	Contractors Pollution Liab			ERA9Y9012	4/21/2012	4/21/2013	\$1,000,000 Each Occurrence

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

--See Attached Remarks Schedule--

CERTIFICATE HOLDER ***Master ** \$1 mil XS	CANCELLATION SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE <div style="text-align: right;"> John L. Wortham & Son, L.P. </div>
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ACORD 25 (2010/05)

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ADDITIONAL REMARKS SCHEDULE

AGENCY John L. Wortham & Son, L.P.		NAMED INSURED Garner Environmental Services, Inc. Attn: Mrs Bobbie K. Risner 1717 W. 13th. Street Deer Park TX 77536	
POLICY NUMBER		EFFECTIVE DATE	
CARRIER	NAIC CODE		

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 **FORM TITLE:** Certificate of Liability (05/10)

CERTIFICATE HOLDER: ***Master ** \$1 mil XS

ADDRESS: _____

As Respects General Liability Policy

Per Form Asper 1211

Clause II. WHO IS AN INSURED

6. Any person or organization with whom you agree to include as an a insured in a written contract, written agreement or permit, but only with respect to bodily injury, property damage, environmental damage or personal and advertising injury arising out of your operations, your work, equipment or premises leased or rented by you, or your products which are distributed or sold in the regular course of a vendor's business, however:

a. A vendor is not an insured as respects bodily injury, property damage, clean-up cost, emergency response cost, crisis cost or personal and advertising injury:

(1) For which the vendor is obligated to pay damages by reason of the assumption of liability in a contract or agreement except that which the vendor would have in the absence of the contract or agreement;

(2) Arising out of any express warranty unauthorized by you;

(3) Arising out of any physical or chemical change in the product made intentionally by the vendor;

(4) Arising out of repackaging, except when unpacked solely for the purpose of inspection, demonstration, testing, or the substitution of parts under instructions from you, and then repackaged in the original container;

(5) Arising out of any failure to make inspections, adjustments, tests or servicing as the vendor has agreed to make or normally undertakes to make in the usual course of business, in connection with the distribution or sale of the products;

(6) Arising out of demonstration, installation, servicing or repair operations, except such operations performed at the vendor's location in connection with the sale of the product;

or
 (7) Arising out of products which, after distribution or sale by you, have been labeled or relabeled or used as a container, part or ingredient of any other thing or substance by or for the vendor.

b. A manager or lessor of premises, a lessor of leased equipment, or a mortgagee, assignee, or receiver is not an insured as respects bodily injury, property damage, clean-up cost, emergency response cost, crisis cost, or personal and advertising injury:

(1) Arising out of any occurrence that takes place after the equipment lease expires or you cease to be a tenant; or

(2) Arising out of structural alterations, new construction or demolition operations performed by or on behalf of the manager or lessor of premises, or mortgagee, assignee, or receiver.

As Respects General Liability Policy:

Per Form Asper 1211

CLAUSE X. CONDITIONS

Transfer of Rights of Recovery Against Others To Us

If the insured has rights to recover all or part of any payment we have made under this Policy, those rights are transferred to us. At our request, the insured will bring suit or transfer those rights to us and help us enforce them. However, if the insured has waived rights of recovery against any person or organization in a written contract or agreement prior to a loss, we waive any right of recovery we may have under this Policy against such person or organization.

As Respects Excess Policy

AGENCY CUSTOMER ID: 10GARNEENV

LOC #: _____



ADDITIONAL REMARKS SCHEDULE

Page _____ of _____

AGENCY John L. Wortham & Son, L.P.	NAMED INSURED Garner Environmental Services, Inc. Attn: Mrs Bobbie K. Risner 1717 W. 13th. Street Deer Park TX 77536
POLICY NUMBER	EFFECTIVE DATE
CARRIER	NAIC CODE

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 **FORM TITLE:** Certificate of Liability (05/10)

CERTIFICATE HOLDER: ***Master ** \$1 mil XS

ADDRESS: _____

CLAUSE I. INSURING AGREEMENT

The insurer will pay on the insured's behalf ultimate net loss (resulting from bodily injury, property damage, personal injury, advertising injury, environmental damage, emergency response costs, clean-up costs or loss) in excess of, and not in contribution with, the underlying policies. Except as otherwise provided in this Policy, this Policy shall follow all provisions, exclusions, limitations, and all other terms and conditions of the followed policy. In the event of a conflict between this Policy and the followed policy, this Policy shall govern and control. Notwithstanding any other provision of this Policy, in no event shall this Policy grant broader coverage than that provided to the insured under any of the underlying policies.

As Respects Automobile Liability Policy

Per Form CA 00 01 03 06, Section IV - Business Auto Conditions, B. General Conditions

5. Other Insurance

a. For any covered "auto" you own, this Coverage Form provides primary insurance. For any covered "auto" you dont own, the insurance provided by this Coverage Form is excess over any other collectible insurance. However, while a covered "auto" which is a "trailer" is connected to another vehicle, the Liability Coverage this Coverage Form provides for the "trailer" is:

- (1) Excess while it is connected to a motor vehicle you do not own.
- (2) Primary while it is connected to a covered "auto" you own.

b. For Hired Auto Physical Damage Coverage, any covered "auto" you lease, hire, rent or borrow is deemed to be a covered "auto" you own. However, any "auto" that is leased, hired, rented or borrowed with a driver is not a covered "auto".

c. Regardless of the provisions of Paragraph a. above, this Coverage Form's Liability Coverage is primary for any liability assumed under an "insured contract".

As Respects General Liability Policy

Per Form Asper 1211

CLAUSE VII. OTHER INSURANCE

A. Primary Insurance

Except as provided in Paragraph B. of this Clause, this insurance is primary. The insurer's obligations as primary insurer are not affected unless any of the other insurance is also primary, the insurer will share with all other primary insurance as follows:

- (1) If all of the other insurance permits contribution by equal shares, the insurer will follow such method also whereby each insurer contributes equal amounts until it has paid its limit of liability or none of the loss remains, whichever comes first; or
- (2) If any of the other insurance does not permit contribution by equal shares, the insurer will contribute by limits whereby each insurer's share is based on the ratio of its limit of liability to the total limits of insurance of all insurers. However, regardless of whether B. below applies, in the event that a written contract or agreement or permit requires this insurance to be primary for any person or organization with whom you agreed to insure and such person or organization is an insured under this policy, we will not seek contributions from any such other insurance issued to such person or organization.

AGENCY CUSTOMER ID: 10GARNEENV

LOC #: _____



ADDITIONAL REMARKS SCHEDULE

Page ____ of ____

AGENCY John L. Wortham & Son, L.P.		NAMED INSURED Garner Environmental Services, Inc. Attn: Mrs Bobbie K. Risner 1717 W. 13th. Street Deer Park TX 77536	
POLICY NUMBER		EFFECTIVE DATE	
CARRIER	NAIC CODE		

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 **FORM TITLE:** Certificate of Liability (05/10)

CERTIFICATE HOLDER: ***Master ** \$1 mil XS

ADDRESS: _____

B. Excess Insurance

This insurance is excess over:

(1) Any other insurance, whether primary, excess, contingent or on any other basis that is: (i) Fire, Extended Coverage, Builder's Risk, Installation Risk or similar coverage for your work; (ii) Fire insurance for premises rented to you or temporarily occupied by you with permission of the owner; (iii) insurance purchased by you to cover your liability as a tenant for property damage to premises rented to you or temporarily occupied by you with permission of the owner; or (iv) insurance applicable to loss arising out of the maintenance or use of aircraft, autos or watercraft.

(2) Any other indemnity or primary insurance available to you covering liability for damages arising out of premises, operations, or the products and completed operations hazard, for which you have been added as an additional insured.

(3) Any project specific primary insurance available to you covering liability for damages arising out of your work, for which you are an insured.

When this insurance is excess, we will have no duty to defend the insured against any suit if any other insurer has a duty to defend the insured against that suit. If no other insurer has a duty to defend, we will undertake to do so, but we will be entitled to the insured's rights against all those other insurers.

When this insurance is excess over other insurance, we will pay only our share of the amount of the loss, if any, that exceeds the sum of the: (a) total amount that all such other insurance would pay for the loss in the absence of this insurance; and (b) total of all deductible, retained and self-insured amounts under all that other insurance. Then, we will share the remaining loss, if any, with any other insurance that is not described in this Clause VI.B. and was not bought specifically to apply in excess of the applicable Limits of Liability of this Policy.

As Respects General Liability Policy

Per Form Asper 1211

CLAUSE X. CONDITIONS

Separation of Insureds

Except as provided in Clause VIII. of this Policy, or as respects any Limit of Liability or any rights or duties specifically assigned in this Policy to the First Named Insured, this Policy applies as if each insured were the only insured and applies separately to each insured against whom a claim is made. Accordingly, any "wrongful act" (meaning any misrepresentation, concealment, breach of a term or condition, or violation of any duty under this Policy) by one insured shall not prejudice the interest of, or coverage for, another insured, except any "wrongful act" of any insured who is a parent, subsidiary or affiliate of the First Named Insured shall be imputed to the First Named Insured. Nonetheless, the insurer shall have the right to limit, cancel or exclude coverage for any particular insured arising from such insured's own "wrongful act."



TO CERTIFICATE HOLDER

Our agency has issued the enclosed certificate of insurance on behalf of our client. We want to share with you some important information regarding certificates of insurance.

The Texas Legislature passed and Governor Perry signed Senate Bill 425 to become effective January 1, 2012. After this date it will be illegal for an agent or insurance company to issue evidence of insurance on a certificate form that has not been approved by the Texas Department of Insurance (TDI). It is also illegal for anyone to require an agent or insurance company to use a certificate form that has not been approved by the State.

The law provides some guidance on the content and limitations of certificates, as follows:

- A certificate is not an insurance policy and does not amend, extend, or alter the coverage afforded by the referenced insurance policy.
- A certificate shall not confer to a certificate holder new or additional rights beyond what the policy and endorsements provide.
- A certificate may not contain a reference to a legal or insurance requirement contained in a contract other than the underlying contract of insurance or endorsement to the insurance policy.
- A person may have a legal right to notice of cancellation, nonrenewal or material change or any similar notice only if (1) the person is named within the policy or an endorsement to the policy, and (2) the policy or endorsement, or a state or rule, requires notice to be provided.
- The law confirms that “a certificate of insurance that is executed, issued, or required and that is in violation with this chapter is void and has no effect.”

Additional information concerning the new law may be obtained by contacting the TDI (800) 252-3439 or visiting the web site <http://www.tdi.texas.gov/rules/informal1216.html>.

For this reason, we may not be able to provide some of the specific certificate holder requested information which is outside the scope of the approved document. We are willing to explain each of these items and provide policy endorsements or other information subject to our client's approval.

We hope you will understand our position and ask that you give us a call if you have any questions or comments.

ITEM THREE - Supplement
 (Business Auto, Truckers & Motor Carrier Coverage Form)

POLICY NO. AS2-641-443542-022

ITEM SEVEN - Supplement
 (Garage Coverage Form - Non Dealers)

**SCHEDULE OF PHYSICAL DAMAGE INSURANCE DEDUCTIBLES FOR
 NEWLY ACQUIRED COVERED AUTOS**

In addition to autos you now own your selection of symbol or in the covered autos column of ITEM TWO provides coverage for those autos you acquire ownership of after the policy begins as shown below:

SCHEDULE OF PHYSICAL DAMAGE INSURANCE DEDUCTIBLES

Physical Damage Insurance is provided for those coverages where a premium entry is shown in ITEM TWO and for those covered autos as shown by the entry of a symbol in the COVERED AUTOS column of ITEM TWO. Deductibles for these autos apply as shown below:

TYPES OF COVERED AUTOS	COVERAGES/DEDUCTIBLES	
	Comprehensive	Collision
All covered autos of the private passenger, light and medium truck types,	\$ 1,000	\$ 1,000
All other covered autos.	\$ 5,000	\$ 5,000
	\$	\$
	\$	\$
	\$	\$
	\$	\$
	\$	\$
	<input type="checkbox"/> Collision Coverage applies only to such covered autos having an Actual Cash Value exceeding \$	

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

COVERED AUTO DESIGNATION SYMBOL

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM
 GARAGE COVERAGE FORM
 MOTOR CARRIER COVERAGE FORM
 TRUCKERS COVERAGE FORM
 BUSINESS AUTO PHYSICAL DAMAGE COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by the endorsement.

Section I – Covered Autos is amended by adding the following:

Item Two of the Declarations shows the "autos" that are covered "autos" for each of your coverages. The following numerical symbols may be used (in addition to the numerical symbols described in the Coverage Form) to describe the "autos" that may be covered "autos". The entry of one of these symbols next to a coverage on the Declarations will designate the only "autos" that are covered "autos".

Symbol		Description Of Covered Auto Designation Symbols
		For use with the Business Auto Coverage Form
10	=	Owned Private Passenger types, Light and Medium power units with Manufacturer's model year 2005 or newer, all other owned power units.

For use with the Garage Coverage Forms

32	=	
----	---	--

For use with the Truckers Coverage Form

51	=	
52	=	

Symbol		Description Of Covered Auto Designation Symbols
For use with the Business Auto Physical Damage Coverage Form		
7	=	
For use with the Motor Carrier Coverage Form		
72	=	
73	=	

Policy No: **AS2-641-443542-022**
 Effective Date: 04/21/12
 Expiration Date: 04/21/13
 Sales Office: 0001

Issued By: Liberty Mutual Fire Insurance Co.

Policy No.: ERA9Y9012
Effective Date: 04/21/12



THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

INSURED CONTRACT DEFINITION AMENDATORY ENDORSEMENT

In consideration of the premium charged, the Definition of **insured contract** is deleted in its entirety and replaced with the following:

Insured contract means: (i) A contract for a lease of premises; provided that portion of the contract for a lease of premises in excess of 30 consecutive days that indemnifies any person or organization for damage by fire, lightning or explosion to premises while rented to you or temporarily occupied by you with permission of the owner is not an **insured contract**; (ii) A side-track agreement; (iii) Any easement or license agreement; (iv) An obligation, as required by ordinance, to indemnify a municipality, except in connection with work for a municipality; (v) An elevator maintenance agreement; (vi) that part of any other contract or agreement pertaining to your business (including an indemnification of a municipality in connection with work performed for a municipality) under which you assume the tort liability of another party to pay for **bodily injury, property damage or environmental damage** to a third person or organization. Tort liability means a liability that would be imposed by law in the absence of any contract or agreement. Provided (vi) does not include that part of any contract or agreement that indemnifies an architect, engineer or surveyor for injury or damage arising out of: (a) Preparing, approving or failing to prepare or approve maps, drawings, opinions, reports, surveys, change orders, designs or specifications; or (b) Giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

All other terms and conditions of this Policy remain unchanged.

ASPER 01/12 <form number pending>

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

DESIGNATED INSURED

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM
GARAGE COVERAGE FORM
MOTOR CARRIER COVERAGE FORM
TRUCKERS COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by this endorsement.

This endorsement identifies person(s) or organization(s) who are "insureds" under the Who Is An Insured Provision of the Coverage Form. This endorsement does not alter coverage provided in the Coverage Form.

SCHEDULE

Name of Person(s) or Organization(s):

Any person or organization whom you have agreed in writing to add as an additional insured, but only to coverage and minimum limits of insurance required by the written agreement, and in no event to exceed either the scope of coverage or the limits of insurance provided in this policy.

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to the endorsement.)

Each person or organization shown in the Schedule is an "insured" for Liability Coverage, but only to the extent that person or organization qualifies as an "insured" under the Who Is An Insured Provision contained in Section II of the Coverage Form.

Policy No: AS2641443542022
Effective Date: 04/21/12
Expiration Date: 04/21/13
Sales Office: 0001

Issued By: Liberty Mutual Fire Insurance Co.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY

**WAIVER OF TRANSFER OF RIGHTS OF RECOVERY
AGAINST OTHERS TO US**

This endorsement modifies insurance provided under the following:

Business Auto Coverage Form
Garage Coverage Form
Truckers Coverage Form
Motor Carrier Coverage Form

SCHEDULE

Premium:

Name of Person or Organization:

Any person or organization for whom you perform work under a written contract if the contract requires you to obtain this agreement from us, but only if the contract is executed prior to the injury or damage occurring.

The TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US condition is amended by the addition of the following:

We waive any right of recovery we may have against the person or organization shown in the Schedule above because of payments we make for injury or damage arising out of your operations of a covered auto done under contract with that person or organization. This waiver applies only to the person or organization shown in the Schedule above.

Policy No: AS2641443542022
Effective Date: 04/21/12
Expiration Date: 04/21/13
Sales Office: 0001

Issued By:
Liberty Mutual Fire Insurance Co.

AX 12 10 02 05 B

Page 1 of 1

WAIVER OF OUR RIGHT TO RECOVER FROM OTHERS ENDORSEMENT

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule. (This agreement applies only to the extent that you perform work under a written contract that requires you to obtain this agreement from us.)

This agreement shall not operate directly or indirectly to benefit anyone not named in the Schedule.

Schedule

All persons or organizations that are parties to a written contract that requires you to obtain this agreement, provided you executed the contract before the loss.

This endorsement is executed by the Liberty Mutual Fire Insurance Company 16586

Premium \$

Effective Date

Expiration Date

For attachment to Policy No. WC2641443542012

WC 00 03 13
Ed. 4/1/1984

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Page 1 of 1

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

LESSOR - ADDITIONAL INSURED AND LOSS PAYEE

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM
 BUSINESS AUTO PHYSICAL DAMAGE COVERAGE FORM
 GARAGE COVERAGE FORM
 MOTOR CARRIER COVERAGE FORM
 TRUCKERS COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by the endorsement.

SCHEDULE

Insurance Company:	
Policy Number: AS2-641-443542-022	Effective Date:
Expiration Date:	
Named Insured:	
Address:	
Additional Insured (Lessor):	Any lessor who has a written contract or agreement requiring you to provide primary coverage for the vehicle(s) specified in the lease.
Address:	
Designation Or Description Of "Leased Autos":	Any leased auto as defined in Paragraph E below.

Coverages	Limit Of Insurance
Liability	\$ Each "Accident"
Comprehensive	Actual Cash Value Or Cost Of Repair Whichever Is Less, Minus \$ Deductible For Each Covered "Leased Auto"
Collision	Actual Cash Value Or Cost Of Repair Whichever Is Less, Minus \$ Deductible For Each Covered "Leased Auto"
Specified Causes Of Loss	Actual Cash Value Or Cost Of Repair Whichever Is Less, Minus \$ Deductible For Each Covered "Leased Auto"
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

A. Coverage

1. Any "leased auto" designated or described in the Schedule will be considered a covered "auto" you own and not a covered "auto" you hire or borrow.
2. For a "leased auto" designated or described in the Schedule, **Who Is An Insured** is changed to include as an "insured" the lessor named in the Schedule. However, the lessor is an "insured" only for "bodily injury" or "property damage" resulting from the acts or omissions by:
 - a. You;
 - b. Any of your "employees" or agents; or
 - c. Any person, except the lessor or any "employee" or agent of the lessor, operating a "leased auto" with the permission of any of the above.
3. The coverages provided under this endorsement apply to any "leased auto" described in the Schedule until the expiration date shown in the Schedule, or when the lessor or his or her agent takes possession of the "leased auto", whichever occurs first.

B. Loss Payable Clause

1. We will pay, as interest may appear, you and the lessor named in this endorsement for "loss" to a "leased auto".
2. The insurance covers the interest of the lessor unless the "loss" results from fraudulent acts or omissions on your part.
3. If we make any payment to the lessor, we will obtain his or her rights against any other party.

C. Cancellation

1. If we cancel the policy, we will mail notice to the lessor in accordance with the Cancellation Common Policy Condition.
 2. If you cancel the policy, we will mail notice to the lessor.
 3. Cancellation ends this agreement.
- D. The lessor is not liable for payment of your premiums.

E. Additional Definition

As used in this endorsement:

"Leased auto" means an "auto" leased or rented to you, including any substitute, replacement or extra "auto" needed to meet seasonal or other needs, under a leasing or rental agreement that requires you to provide direct primary insurance for the lessor.

Policy No: AS2-641-443542-022
 Effective Date: 04/21/12
 Expiration Date: 04/21/13
 Sales Office: 0001

Issued By: Liberty Mutual Fire Insurance Co.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

POLLUTION LIABILITY – BROADENED COVERAGE FOR COVERED AUTOS – BUSINESS AUTO, MOTOR CARRIER AND TRUCKERS COVERAGE FORMS

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM
MOTOR CARRIER COVERAGE FORM
TRUCKERS COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by the endorsement.

A. Liability Coverage is changed as follows:

1. Paragraph a. of the **Pollution** Exclusion applies only to liability assumed under a contract or agreement.
2. With respect to the coverage afforded by Paragraph A.1. above, Exclusion **B.6. Care, Custody Or Control** does not apply.

B. Changes In Definitions

For the purposes of this endorsement, Paragraph **D.** of the **Definitions** Section is replaced by the following:

- D.** "Covered pollution cost or expense" means any cost or expense arising out of:
1. Any request, demand, order or statutory or regulatory requirement that any "insured" or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of "pollutants"; or
 2. Any claim or "suit" by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to or assessing the effects of "pollutants".

"Covered pollution cost or expense" does not include any cost or expense arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants":

- a. Before the "pollutants" or any property in which the "pollutants" are contained are moved from the place where they are accepted by the "insured" for movement into or onto the covered "auto"; or
- b. After the "pollutants" or any property in which the "pollutants" are contained are moved from the covered "auto" to the place where they are finally delivered, disposed of or abandoned by the "insured".

Paragraphs a. and b. above do not apply to "accidents" that occur away from premises owned by or rented to an "insured" with respect to "pollutants" not in or upon a covered "auto" if:

- (1) The "pollutants" or any property in which the "pollutants" are contained are upset, overturned or damaged as a result of the maintenance or use of a covered "auto"; and
- (2) The discharge, dispersal, seepage, migration, release or escape of the "pollutants" is caused directly by such upset, overturn or damage.

Policy No: **AS2-641-443542-022** Issued By: Liberty Mutual Fire Insurance Company
Effective Date: 04/21/12
Expiration Date: 04/21/13
Sales Office: 0001

MARITIME COVERAGE ENDORSEMENT

This endorsement changes how insurance provided by Part Two (Employers Liability Insurance) applies to bodily injury to a master or member of the crew of any vessel.

A. How This Insurance Applies is replaced by the following:

A. How This Insurance Applies

This insurance applies to bodily injury by accident or bodily injury by disease. Bodily injury includes resulting death.

1. The bodily injury must arise out of and in the course of the injured employee's employment by you.
2. The employment must be necessary or incidental to work described in Item 1 of the Schedule of the Maritime Coverage Endorsement.
3. The bodily injury must occur in the territorial limits of, or in the operation of a vessel sailing directly between the ports of, the continental United States of America, Alaska, Hawaii or Canada.
4. Bodily injury by accident must occur during the policy period.
5. Bodily injury by disease must be caused or aggravated by the conditions of your employment. The employee's last day of last exposure to the conditions causing or aggravating such bodily injury by disease must occur during the policy period.
6. If you are sued, the original suit and any related legal actions for damages for bodily injury by accident or by disease must be brought in the United States of America, its territories or possessions, or Canada.

C. Exclusions is changed by removing exclusion 10 and by adding exclusions 13 and 14.

This insurance does not cover:

13. Bodily injury covered by a Protection and Indemnity Policy or similar policy issued to you or for your benefit. This exclusion applies even if the other policy does not apply because of another insurance clause, deductible or limitation of liability clause, or any similar clause.
14. Your duty to provide transportation, wages, maintenance and cure. This exclusion does not apply if a premium entry is shown in Item 2 of the Schedule.

D. We Will Defend is changed by adding the following statement:

We will treat a suit or other action in rem against a vessel owned or chartered by you as a suit against you.

G. Limits of Liability

Our liability to pay for damages is limited. Our limits of liability are shown in the Schedule. They apply as explained below.

WC 00 02 01 A

Page 1 of 2

ED 4/1992

MARITIME COVERAGE ENDORSEMENT

1. Bodily Injury by Accident. The limit shown for "bodily injury by accident-each accident" is the most we will pay for all damages covered by this insurance because of bodily injury to one or more employees in any one accident.
A disease is not bodily injury by accident unless it results directly from bodily injury by accident.
2. Bodily Injury by Disease. The limit shown for "bodily injury by disease-aggregate" is the most we will pay for all damages covered by this insurance because of bodily injury by disease to one or more employees. The limit applies separately to bodily injury by disease arising out of work in each state shown in Item 3.A. of the Information Page. Bodily injury by disease will be deemed to occur in the state of the vessel's home port.
Bodily injury by disease does not include disease that results directly from a bodily injury by accident.
3. We will not pay any claims for damages after we have paid the applicable limit of our liability under this insurance.

Schedule

1. Description of work:

All Maritime Operations

2. Transportation, Wages, Maintenance and Cure Premium

3. Limits of Liability	Bodily Injury by Accident	\$1,000,000	each accident
	Bodily Injury by Disease	\$1,000,000	aggregate

This endorsement is executed by the Liberty Mutual Fire Insurance Company 16586

Premium \$

Effective Date

Expiration Date

For attachment to Policy No. WC2-641-44354-012

WC 00 02 01 A
Page 2 of 2
ED 4/1992

OUTER CONTINENTAL SHELF LANDS ACT COVERAGE ENDORSEMENT

This endorsement applies only to the work described in Item 4 of the Information Page or in the Schedule as subject to the Outer Continental Shelf Lands Act. The policy will apply to that work as though the location shown in the Schedule were a state named in Item 3.A. of the Information Page.

General Section C. **Workers' Compensation Law** is replaced by the following:

C. **Workers' Compensation Law**

Workers' Compensation Law means the workers or workmen's compensation law and occupational disease law of each state or territory named in Item 3.A. of the Information Page and the Outer Continental Shelf Lands Act (43 USC Sections 1331-1356). It includes any amendments to those laws that are in effect during the policy period. It does not include any other federal workers or workmen's compensation law, other federal occupational disease law or the provisions of any law that provide nonoccupational disability benefits.

Part Two (Employers Liability Insurance), C. Exclusions., exclusion 8, does not apply to work subject to the Outer Continental Shelf Lands Act.

Schedule

Description and Location of Work

This endorsement is executed by the Liberty Mutual Fire Insurance Company 16586

Premium \$

Effective Date

Expiration Date

For attachment to Policy No. WC2-641-44354-012

WC 00 01 09 A

Page 1

Ed. 4/1992

LONGSHORE AND HARBOR WORKERS' COMPENSATION ACT COVERAGE ENDORSEMENT

This endorsement applies only to work subject to the Longshore and Harbor Workers' Compensation Act in a state shown in the Schedule. The policy applies to that work as though that state were listed in Item 3.A. of the Information Page.

General Section C. **Workers' Compensation Law** is replaced by the following:

C. Workers' Compensation Law

Workers' Compensation Law means the workers or workmen's compensation law and occupational disease law of each state or territory named in Item 3.A. of the Information Page and the Longshore and Harbor Workers' Compensation Act (33 USC Sections 901-950). It includes any amendments to those laws that are in effect during the policy period. It does not include any other federal workers or workmen's compensation law, other federal occupational disease law or the provisions of any law that provide nonoccupational disability benefits.

Part Two (Employers Liability Insurance), C. Exclusions., exclusion 8, does not apply to work subject to the Longshore and Harbor Workers' Compensation Act.

This endorsement does not apply to work subject to the Defense Base Act, the Outer Continental Shelf Lands Act, or the Nonappropriated Fund Instrumentalities Act.

<u>State</u>	Schedule	<u>Longshore and Harbor Workers' Compensation Act Coverage Percentage</u>
REFER TO SCHEDULE GPO 2926 FOR STATES AND PERCENTAGES		
Each state named in Item 3.A of the Information Page and the states of ND, OH, WA & WY.		

The rates for classifications with code numbers not followed by the letter "F" are rates for work not ordinarily subject to the Longshore and Harbor Workers' Compensation Act. If this policy covers work under such classifications, and if the work is subject to the Longshore and Harbor Workers' Compensation Act, those non-F classification rates will be increased by the Longshore and Harbor Workers' Compensation Act Coverage Percentage shown in the Schedule.

This endorsement is executed by the Liberty Mutual Fire Insurance Company 16586

Premium \$

Effective Date

Expiration Date

For attachment to Policy No. WC2-641-443542-012

WC 00 01 06 A

Page 1 of 1

ED. 4/92

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VOLUNTARY COMPENSATION MARITIME COVERAGE ENDORSEMENT

This endorsement adds Voluntary Compensation Maritime Insurance to the policy.

A. How This Insurance Applies

This insurance applies to bodily injury by accident or bodily injury by disease. Bodily injury includes resulting death.

1. The bodily injury must be sustained by an employee who is a master or member of the crew of a vessel described in the Schedule.
2. The bodily injury must occur in employment that is necessary or incidental to work described in Item 2 of the Schedule.
3. The bodily injury must occur in the territorial limits of, or in the operation of a vessel sailing directly between the ports of, the continental United States of America, Alaska, Hawaii or Canada.
4. Bodily injury by accident must occur during the policy period.
5. Bodily injury by disease must be caused or aggravated by the conditions of your employment. The employee's last day of last exposure to the conditions causing or aggravating such bodily injury by disease must occur during the policy period.

B. We Will Pay

We will pay an amount equal to the benefits that would be required of you if you and your employees described in Item 1 of the Schedule were subject to the workers compensation law shown in Item 1 of the Schedule. We will pay those amounts to the persons who would be entitled to them under that law.

C. Exclusions

This insurance does not cover:

1. any obligation imposed by a workers compensation or occupational disease law, or any similar law.
2. bodily injury intentionally caused or aggravated by you.

D. Before We Pay

Before we pay benefits to the persons entitled to them, they must:

1. release you and us, in writing, of all responsibility for the injury or death.
2. transfer to us their right to recover from others who may be responsible for the injury or death.
3. cooperate with us and do everything necessary to enable us to enforce the right to recover from others.

If the persons entitled to the benefits of this insurance fail to do those things, our duty to pay ends at once. If they claim damages from you or from us for the injury or death, our duty to pay ends at once.

E. Recovery From Others

If we make a recovery from others, we will keep an amount equal to our expenses of recovery and the benefits we paid. We will pay the balance to the persons entitled to it. If the persons entitled to the benefits of this insurance make a recovery from others, they must reimburse us for the benefits we paid them.

WC 00 02 03

Page 1 of 2

Ed. 4/1/1984

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VOLUNTARY COMPENSATION MARITIME COVERAGE ENDORSEMENT

Schedule

1. **Employees**
Master and members of the crews
of these vessels :
All Vessels

Workers Compensation Law
State of Hire

2. **Description of Work:**
All Maritime Operations

This endorsement is executed by the Liberty Mutual Fire Insurance Company 16586

Premium \$

Effective Date

Expiration Date

For attachment to Policy No. WC2-641-44354-012

WC 00 02 03

Page 2 of 2

Ed. 4/1/1984

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ALTERNATE EMPLOYER ENDORSEMENT

This endorsement applies only with respect to bodily injury to your employees while in the course of special or temporary employment by the alternate employer in the state named in Item 2 of the Schedule. Part One (Workers Compensation Insurance) and Part Two (Employers Liability Insurance) will apply as though the alternate employer is insured. If an entry is shown in Item 3 of the Schedule the insurance afforded by this endorsement applies only to work you perform under the contract or at the project named in the Schedule.

Under Part One (Workers Compensation Insurance) we will reimburse the alternate employer for the benefits required by the workers compensation law if we are not permitted to pay the benefits directly to the persons entitled to them.

The insurance afforded by this endorsement is not intended to satisfy the alternate employer's duty to secure its obligations under the workers compensation law. We will not file evidence of this insurance on behalf of the alternate employer with any government agency.

We will not ask any other insurer of the alternate employer to share with us a loss covered by this endorsement.

Premium will be charged for your employees while in the course of special or temporary employment by the alternate employer.

The policy may be canceled according to its terms without sending notice to the alternate employer.

Part Four (Your Duties If Injury Occurs) applies to you and the alternate employer. The alternate employer will recognize our right to defend under Parts One and Two and our right to inspect under Part Six.

- | | Schedule |
|---|----------|
| | Address |
| <p>1. Alternate Employer
Any</p> | |
| <p>2. State of Special or Temporary Employment
Any</p> | |
| <p>3. Contract or Project</p> | |

This endorsement is executed by the Liberty Mutual Fire Insurance Company 16586

Premium \$

Effective Date

Expiration Date

For attachment to Policy No. WC2641443542012

WC 00 03 01 A
Page 1 of 1
Ed. 02/1/1989

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GARNER ENVIRONMENTAL SERVICES, INC.

CORPORATE OFFICE: 1717 W. 13TH STREET, DEER PARK, TX 77536 • 281-930-1200 • 800-424-1716

Garner Environmental Services - OSRO Number: 27

COTP Zone:	Operating Environment	Facility MMPD	Facility WCD1	Facility WCD2	Facility WCD3	Vessel MMPD	Vessel WCD1	Vessel WCD2	Vessel WCD3
Corpus Christi - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corpus Christi - DISTRICT 8	Inland	Yes	~	Yes	Yes	Yes	Yes	Yes	Yes
Houston - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Houston - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lower Mississippi - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lower Mississippi - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile(Panama City, FL) - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile(Panama City, FL) - DISTRICT 8	Inland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Morgan City - DISTRICT 8	River or Canal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

BRANCH OFFICES

DEER PARK, TX
(OPERATION & TRAINING)
281-930-1200

• PORT ARTHUR, TX
(OPERATIONS)
409-983-5646

• PORT ARTHUR, TX
(TRAINING)
409-984-9836

• LA MARQUE, TX
(OPERATIONS)
409-935-0308



GARNER ENVIRONMENTAL SERVICES, INC.

CORPORATE OFFICE: 1717 W. 13TH STREET, DEER PARK, TX 77536 • 281-930-1200 • 800-424-1716

Morgan City - DISTRICT 8	Inland	Yes							
New Orleans - DISTRICT 8	River or Canal	Yes							
New Orleans - DISTRICT 8	Inland	Yes							
Port Arthur - DISTRICT 8	River or Canal	Yes							
Port Arthur - DISTRICT 8	Inland	Yes							

BRANCH OFFICES

DEER PARK, TX
(OPERATION & TRAINING)
281-930-1200

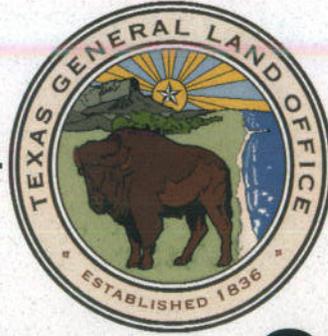
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(OPERATIONS)
409-983-5646

• PORT ARTHUR, TX
(TRAINING)
409-984-9836

• LA MARQUE, TX
(OPERATIONS)
409-935-0308

Date: October 1, 2009

DCO # 509

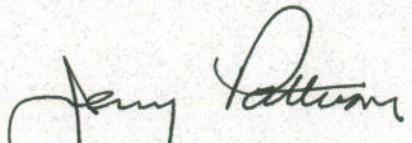


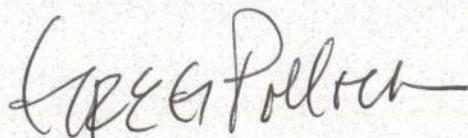
Discharge Cleanup Organization Certificate

Garner Environmental Services

Deer Park, Texas

This certificate carries with it the need to maintain a high level of response preparedness, to respond in a timely, professional manner, and to notify the Texas General Land Office of any change in the Holder's ability to accomplish this mission. Certification is for three years from the above date.


Commissioner
Texas General Land Office


Deputy Commissioner
Oil Spill Prevention and Response

CLEAN CHANNEL ASSOCIATION OWNED EQUIPMENT

- A. Equipment located at CCA/Pasadena office/warehouse
1. Trailer containing 1700 feet of 18" oil spill containment boom with related equipment including, without limitation, tow bridals and anchors;
 2. Trailer containing 1000 feet of 24" oil spill containment boom
 3. Two (2) 18' outboard powered workboats
 4. Three (3) each three-inch diesel driven portable pumps with portable hoses
 5. Two (2) each two-inch diesel driven portable pumps with hoses
 6. One (1) Pharos Marine GT-185 skimming system with hydraulic power pack
 7. One (1) Gastech LEL/OXY/H₂S meter
 8. 2,000 feet of 8" oil spill containment boom
 9. Two (2) portable weir skimmers (Douglas 18000)
 10. One (1) Sludgemaster Pump for heavy oils (300 gpm)
 11. One (1) 40' shipping container
 12. One (1) 18' Boston Whaler with 150 hp engine
 13. One (1) LORI skimming system mounted on a 26' vessel with 20 bbls storage.
 14. One (1) JBF DIP 402 Skimmer Vessel
 15. One (1) 24' decontamination trailer, supplies for 100 showers, and cleaning materials
- B. One 40' shipping container located at Dow Chemical Co., Freeport, Texas equipped with the following:
1. 1,000 feet of 36" oil spill containment boom with related equipment including, without limitation, tow bridals and anchors
 2. One each three-inch diesel driven portable pump with portable hoses
 3. One portable weir skimmer (Douglas 18000)
 4. One 2,100 gal. Fastank portable storage container
- C. The following equipment is owned by Clean Channel Association and normally stored on board vessels *Clean Channel 2* and *Clean Channel 3*:
1. 1,000 feet of 18" oil spill containment boom (each skimmer barge)
 2. One (1) portable weir skimmer (Douglas 18000) with hoses (each skimmer barge)
- D. One (1) 20' trailer located at T&T Marine Salvage, Galveston, Texas, containing 1,000 feet of 18" oil spill containment boom.
- E. One (1) LORI skimming system mounted on a 24' vessel with 50 bbls storage located in Freeport, Texas.
- F. One (1) JBF DIP 402 Skimmer Vessel located at Shell Oil Deer Park Refinery.
1. 2,000 feet of 24" oil spill containment boom
- G. 1,000 feet of 24" oil spill containment boom located at Westway Terminal, Galena Park, TX

CLEAN CHANNEL ASSOCIATION LEASED EQUIPMENT

Clean Channel 2 and Clean Channel 3 - Two (2) recovery barges 30' x 120' with 1,500 bbl capacity with oil recovery system and related equipment including:

1. Built-in weir skimming system
2. One (1) Cargo pump 4", electric driven
3. Three (3) Trash pump 3", electric driven
4. One (1) 100kw diesel powered generator
5. Three (3) 2" double diaphragm air pumps
6. Two (2) Elastec Model 136 2-drum drum skimmers

NOTE: *Equipment list provided by CCA on 08-27-12 (Karen Storm)*

GARNER ENVIRONMENTAL SERVICES, INC.

1717 West 13th Street

Deer Park, Texas 77536

Toll Free: (800) 424-1716

Telephone: (281) 930-1200

Fax: (281) 478-0296

RESPONSE EQUIPMENT LISTING

Corporate	Response Equipment Listing	Equipment Listing
Operations		Rev. December, 2011

BOOM TYPE CODE		END CONNECTOR CODE	
F	Fence	ASTM	ASTM Std (D962-86)
FR	Fire	BOLT	Bolt Connector
PI	Inflatable (Press)	HP	Hinge & Pin
SI	Inflatable (Self)	Z RC	Quick-Connect Z
MR	Marsh (Upper air chamber with lower water chamber)	SNAV	Raised Channel
R	Round	SLOT	Slide (US Navy)
SB	Weir Boom	US1	Slotted Tube
OT	Other	US2	Universal Slide Type 1
		OT	Universal Slide Type 2
			Other

BOOM EQUIPMENT									
Name of Manufacturer	Model Number	Boom Type Code	Invent Length (feet)	Skirt Size (in.)	Float Size (in.)	End Connector Type Code	Time to Deploy	Storage Location	Owner
Acme Products Co.	OK CORRAL	R	22,000	12	6	Z	6.0	Deer Park	Garner
Acme Products Co.	SUPER-MINI	R	800	4	2.5	BOLT	2.0	Deer Park	Garner
Acme Products Co.	OK CORRAL	R	10,000	12	6	Z	6.0	La Marque	Garner
Acme Products Co.	OK CORRAL	R	800	28	8	Z	1.0	La Marque	Garner
Acme Products Co.	OK CORRAL	R	5,000	12	6	Z	2.5	Port Arthur	Garner
Acme Products Co.	SUPER-MINI	R	100	4	2.5	BOLT	0.5	Port Arthur	Garner
Acme Products Co.	OK CORRAL	R	4000	34	8	Z	2.0	Port Arthur	Garner
Acme Products Co.	OK CORRAL	R	2000	34	8	Z	2.0	Port Arthur	Garner
Acme Products Co.	OK CORRAL	R	10,000	12	6	Z	6.0	Deer Park/ Port Arthur	Garner
Acme Products Co.	MINI-BOOM	R	700	4	2.5	BOLT	1.0	Port Arthur	Garner

Corporate	Response Equipment Listing	Equipment Listing
Operations		Rev. December 2011

COMMUNICATIONS TYPE CODES			
AF	Aviation Frequency	MF	Marine Frequency
CP	Cellular Phone	PAG	Pager
COM	Command Post	PHH	Portable Hand Held
MOD	Computer w/modem	SSB	Single Side Band
FAX	Facsimile	TP	Telephone
FBS	Fixed Base Station	OT	Other

COMMUNICATIONS EQUIPMENT

Name of Manufacturer	Model Number	Comm Type	Nr. of Units	Frequency	Band	Range (miles)	Field Tunable		Storage Location	Owner
							Yes	No		
Motorola	A05J	PAG	20	931.462	FM	150		x	Deer Park	Garner
Motorola	F09LF	CP	40	152.840	FM	200		X	Deer Park	Garner
40' Garner Command Post		COM	1					X	Deer Park	Garner
26' Communications Trailer	MCC1	COM	1	931.462			X		La Marque	Garner
Motorola	A05J	PAG	20	931.462	FM	150		X	La Marque	Garner
Motorola	F09LF	PHH	20					X	La Marque	Garner
Motorola	A05J	PAG	12	931.462	FM	150		X	Port Arthur	Garner
Motorola	F09LF	CP	12	152.840	FM	200		X	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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RESPONSE VEHICLES						
Name of Manufacturer	Response Vehicle	Number of Units	Wide Load Permit Needed		Storage Location	Owner
			Yes	No		
Wabash	48' Box Vans, Hard Boom Trailers	2		X	Deer Park	Garner
Fruehauf	48' Box Van, Sorbent Boom Trailer	1		X	Deer Park	Garner
Ford/Chevy	Pick-up Truck, 1 ton	20		X	Deer Park	Garner
Sooner	Emergency Response Trailer, 32'	3		X	Deer Park	Garner
Modern Mfg.	Boom Trailer, 20' Gooseneck	4		X	Deer Park	Garner
Containment Sys. & Gooseneck	Emergency Haz-Mat Response Trailers 32' & 24'	2		X	Deer Park	Garner
Falcon	Trailer, 20', Stand-by/Rescue	3		X	Deer Park	Garner
Pace	28' Rescue Standby & Command Post	2		X	Deer Park	Garner
Ford/Chevy	Pick-up Truck, 1 ton	13		X	La Marque	Garner
Garner	Roll-Off Box, 20 yd.;	2		X	La Marque	Garner
Sooner	Emergency Response Trailer, 32'	1		X	La Marque	Garner
Modern Mfg.	Boom Trailer, 20' Gooseneck	3		X	La Marque	Garner
Iron Horse	Boom Trailer, 20 Gooseneck	2		X	La Marque	Garner
Modern Mfg.	Spill Trailer, 16' Lo-Boy	4		X	La Marque	Garner
Modern Mfg.	Spill Trailer, 20'	2		X	La Marque	Garner
Ford	Pick-up Truck, 1 ton	7		X	Port Arthur	Garner
Sooner	Emergency Response Trailer, 32''	1		X	Port Arthur	Garner
Modern Mfg.	Trailer, Spill Response, 16' Lo-Boy	1		X	Port Arthur	Garner
Modern Mfg.	Boom Trailer, Gooseneck, 20'	3		X	Port Arthur	Garner
Gemini Cargo	Trailer, Haz-Mat, 19'	1		X	Port Arthur	Garner
Ford/Chevy	Pick-up Truck, 1 ton (2 Deer Park & 4 Port Arthur)	6		X	Deer Park / Port Arthur	Garner
Modern Mfg.	Spill Trailer, 20' Lo-Boy	2		X	Port Arthur	Garner
Pace American	36' Haz Mat Response Trailer	1		X	Deer Park	Garner
Modern Mfg.	21' Oil Spill Response Trailer (Boat/ Boom/ Sorbent)	1		X	Port Arthur	Garner
Gooseneck	20' Response Trailer (Industrial Response)	1		X	Deer Park	Garner
Modern Mfg.	Boom Trailer, Gooseneck, 20'	2		X	Port Arthur	Garner
	8' Utility Trailers	1		X	Port Arthur	Garner
Sooner	Spill Trailer 32' Response	1		X	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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BOOM EQUIPMENT

Name of Manufacturer	Model Number	Equipment Type	Quantity	Storage Location	Owner
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	25	Deer Park	Garner
Polycord	600x1/4	Rope, Polypropylene, 1/4" x 600'	5	Deer Park	Garner
Polycord	600x1/2	Rope, Polypropylene, 1/2" x 600'	5	Deer Park	Garner
U.S. Anchor Mfg., Inc.	22#	Anchor, Galvanized Steel, 22 lb., Danforth Style	11	Deer Park	Garner
U.S. Anchor Mfg., Inc.	40#	Anchor, Galvanized Steel, 40 lb., Danforth Style	6	Deer Park	Garner
U.S. Anchor Mfg., Inc.	75#	Anchor, Galvanized Steel, 75 lb., Danforth Style	8	Deer Park	Garner
U.S. Anchor Mfg. Inc.	100#	Anchor, Galvanized Steel, 100 Lb. Danforth Style	13	Deer Park	Garner
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	25	La Marque	Garner
Polycord	600 x1/4	Rope Polypropylene, 1/4" x 600'	5	La Marque	Garner
Polycord	600 x 1/2	Rope Polypropylene, 1/2" x 600'	5	La Marque	Garner
U.S. Anchor Mfg., Inc.	22#	Anchor, Galvanized Steel, 22 lb., Danforth Style	8	La Marque	Garner
U.S. Anchor Mfg., Inc.	40#	Anchor, Galvanized Steel, 40 lb., Danforth Style	5	La Marque	Garner
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	15	Port Arthur	Garner
Polycord	600 x 1/4	Rope Polypropylene 1/4 " x 600 '	5	Port Arthur	Garner
Polycord	600 x 1/2	Rope Polypropylene 1/2 " x 600'	5	Port Arthur	Garner
U.S. Anchor Mfg., Inc.	22 #	Anchor, Galvanized Steel, 22 lb., Danforth Style	12	Port Arthur	Garner
U.S. Anchor Mfg., Inc.	75#	Anchor, Galvanized Steel, 75 lb., Danforth Style	6	Port Arthur	Garner
U.S. Anchor Mfg., Inc.	100#	Anchor, Galvanized Steel, 75 lb., Danforth Style	4	Port Arthur	Garner
Norfloat	A2	Buoy, Anchor Marker, Inflatable, 18" dia.	20	Deer Park	Garner
Polycord	600 x1/4	Rope Polypropylene, 1/4" x 600'	5	Deer Park	Garner
Polycord	600 x 1/2	Rope Polypropylene, 1/2" x 600'	5	Deer Park	Garner
U.S. Anchor Mfg., Inc.	22 #	Anchor, Galvanized Steel, 18 lb., Danforth Style	20	Deer Park	Garner
U.S. Anchor Mfg., Inc.	40 #	Anchor, Galvanized Steel, 22 lb., Danforth Style	8	Deer Park	Garner
U.S. Anchor Mfg. Inc.	100 #	Anchor, Galvanized Steel, 100 #, Danforth Style	10	Deer Park	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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AIR MONITORING EQUIPMENT				
Name of Manufacturer	Miscellaneous Equipment	Number of Units	Storage Location	Owner
Rae Systems	Q-RAE	4	Deer Park	Garner
Rae Systems	Mini RAE 2000	2	Deer Park	Garner
Rae Systems	Ultra Rae	1	Deer Park	Garner
MSA	5 Star	3	Deer Park	Garner
MSA	Watchman	1	Deer Park	Garner
Arizona Instruments	Jerome X431	2	Deer Park	Garner
Elmer Perkins	Micro FID	1	Deer Park	Garner
Draeger	CMS	2	Deer Park	Garner
Ludlum	Model # 3	2	Deer Park	Garner
MSA	4-Gas Meter	3	La Marque	Garner
Draeger	Accuro Pump	1	La Marque	Garner
Rae	Photo-Ionization Detector	1	La Marque	Garner
	Mercury Vapor Analyzer	1	Deer Park	Garner
	Radiation Monitor	1	Deer Park	Garner
	Solar Radiation Monitor	1	Deer Park	Garner
	Weather Station	2	Deer Park	Garner
	Infrared Thermometer	1	Deer Park	Garner
	GPS Units	2	Deer Park	Garner
Aim	4-Gas Monitor	2	Deer Park	Garner
Draeger	Accuro Pump	2	Deer Park	Garner
Draeger	CMS Meter	1	Deer Park	Garner
Rae	Mini-Rae 2000 Portable VOC Meter	2	Deer Park	Garner
Quest	Single Gas Personal Meter	1	Deer Park	Garner
MSA	Escort Particulate Air Monitor	1	Deer Park	Garner
Sper Scientific	PH Meter	1	Deer Park	Garner
Dexsil	PetroFlag Hydrocarbon Test Kit	1	Deer Park	Garner
Chlorine	AC/ Kit	1	Deer Park	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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Name of Manufacturer	Specialty Equipment	Number of Units	Storage Location	Owner
Scott	Self Contained Breathing Apparatus(SCBA) with 12 extra bottles / Scott	12	Deer Park	Garner
Draeger	Self Contained Breathing Apparatus (SCBA) with 12 extra bottles / Draeger	12	Deer Park	Garner
	Bezt Valve / Off Loading Valve	2	Deer Park	Garner
	Chorine Emergency Kit A	1	Deer Park	Garner
	Chorine Emergency Kit B	1	Deer Park	Garner
	Chorine Emergency Kit C	1	Deer Park	Garner
	Vacuum Cleaner / Stainless Steel, Mercury, HEPA	2	Deer Park	Garner
	Cameras / Digital	10	Deer Park	Garner
	Confine Space Rescue Kits	3	Deer Park	Garner
	Coppus Blowers	2	Deer Park	Garner
	Air Compressors 11.8 cfm 90 psi	8	Deer Park	Garner
	Drum Crushers / Diesel Power	2	Deer Park	Garner
	Drum Crabber	5	Deer Park	Garner
	Generators	4	Deer Park	Garner
	Scare Guns	3	Deer Park	Garner
	Decontamination Pools 20" x 100'	2	Deer Park	Garner
	Fan, Ventilation 48'	3	Deer Park	Garner
	Artic Cat, Four Wheeler	1	Deer Park	Garner
	Light Stands	5	Deer Park	Garner
	Self Contained Breathing Apparatus (SCBA) with Extra bottles	9	La Marque	Garner
	Air Compressors (Portable)	8	La Marque	Garner
	HEPA Vacuums	3	La Marque	Garner
	Cameras / Digital	3	La Marque	Garner
	Artic Cat, Four Wheeler	2	La Marque	Garner
	Generators	4	La Marque	Garner
	Self Contain Breathing Apparatus (SCBA)	10	Port Arthur	Garner
	Cameras / Digital	1	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing
		Rev. December 2011

	Specialty Equipment / Continued			
	Coppus Blowers	1	Port Arthur	Garner
	Air Compressors	3	Port Arthur	Garner
	Generators	1	Port Arthur	Garner
	Scare Guns	4	Port Arthur	Garner
	Pressure Washers	1	Port Arthur	Garner
	Explosion Proof Lights	1	Port Arthur	Garner
	Weed Eaters	1	Port Arthur	Garner
	Chlorine Emergency Kit "C"	1	Deer Park	Garner
	Midland Kit	1	Deer Park	Garner
	Railcar Haz Hammock	1	Deer Park	Garner
	Mercury Vacuum	1	Deer Park	Garner
	Carbon Filter Systems	1	Deer Park	Garner
	Sand Filter Systems	2	Deer Park	Garner
	Wet & Dry Vacuum with HEPA Filter	1	Deer Park	Garner
	100 Watt Explosion Proof Light Sets	2	Deer Park	Garner
	Decon Pools 4' x4' x14' 5"	2	Deer Park	Garner
	Spill Guard 6' x 4' x8"	1	Deer Park	Garner
	Drum Dolly	3	Deer Park	Garner
	3/4 " Core Sampler	1	Deer Park	Garner
	Soil Sampler (boring) Kit	1	Deer Park	Garner
	Self Contained Breathing Apparatus (SCBA)	9	Deer Park	Garner
	Generators (Portable)	3	Deer Park	Garner
	Weed Eaters	5	Deer Park	Garner
	Air Compressors (Portable)	2	Deer Park	Garner
	Light Stand (Portable)	2	Deer Park	Garner
	Coppus Blower	1	Deer Park	Garner
	Chain Saw	1	Deer Park	Garner
	Tank Truck Emergency Transfer Valve	1	Deer Park	Garner
	Artic Cat , Four Wheeler	1	Port Arthur	Garner
	16' Trailer Mounted Steam Cleaner with Tank	1	Port Arthur	Garner
	Air Horn, 6"	1	Deer Park	Garner
	Fan Ventilation, 48"	1	Deer Park	Garner
	Fan Ventilation, 16" Port A Cool with water Mister	1	Deer Park	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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	Digital Cameras	4	Deer Park	Garner
A	Auger/Screw	D	Diesel	
C	Fire Peristaltic	E	Electric	
P	Reciprocating	G	Gasoline	
R	Rotary/Flexible impeller	H	Hydraulic	
I	Other	P	Pneumatic	
OT		OT	Other	

PUMP EQUIPMENT

Name of Manufacturer	Model Number	Pump Type Code	Drive Type Code	Suction/ Discharge Size (inches)	Mfg. Pump Rate (gpm)	Quantity	Storage Location	Owner
Aro/Ingersoll Rand	KO176-44	P	P	1.0	120	2	Deer Park	Garner
Honda	WXT-20	G	I	2.0	180	4	Deer Park	Garner
Yanmar	LD-40/2	D	I	2.0	180	2	Deer Park	Garner
Honda	WXT-30	G	I	3.0	275	1	Deer Park	Garner
Wilden	Model M	P	P	3.0	240	5	Deer Park	Garner
Honda	WXT-20	G	I	2.0	180	3	La Marque	Garner
Yanmar	LD-40/2	D	I	2.0	180	5	La Marque	Garner
Wilden	Model M	OT	P	3.0	240	7	La Marque	Garner
Acme Products Co., Inc.	FS-150A	G	I	1.5	275	1	Port Arthur	Garner
Honda	WXT-20	G	I	2.0	180	6	Port Arthur	Garner
Yanmar	LD-40/3	D	I	2.0	200	2	Port Arthur	Garner
Versa-Matic		OT	P	2.0	140	1	Deer Park	Garner
Versa-Matic		OT	P	1.5	140	1	Deer Park	Garner
Honda	EPT2	G	I	3.0	275	1	Deer Park	Garner
Wisconsin/Multi Quip		D	I	3.0	185	1	Deer Park	Garner
Yamada	POLY	P	P	3.0	200	1	Deer Park	Garner
Various		D	I	2.0	200	5	Deer Park	Garner
Various		G	I	2.0	190	2	Deer Park	Garner
Versa-Matic	STAINLESS	P	P	2.0	140	2	Deer Park	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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RESPONSE BOAT TYPE CODES		TRANSPORTATION METHOD CODES	
BAY	Bay Waters	NT	Normal Trailer
JB	Jon Boat	WO	Water Only
LFB	Large Flat Bottom	WL	Wide load Trailer
OFF	Offshore	OT	Other
PRO	Protected Waters		
TC	Towing Capable		
OT	Other		

RESPONSE BOATS										
Name of Manufacturer	Model Number	Boat Type Code	Horse Power	Normal Crew Size	Length / Beam	Draft Limit	Number of Boats	Transport Method Code	Storage Location	Owner
Alumacraft	12	PRO	0	1	12	1'	2	NT	Deer Park	Garner
Custom Flat	1650	JB	25	2	16'	1'	4	NT	Deer Park	Garner
Custom Flat	20	LFB	40	2	20' / 6'	2'	1	NT	Deer Park	Garner
Custom Build	30	BAY	300	3	30' / 8'	2'	1	NT	Deer Park	Garner
Alumaweld	1650	JB	25	3	16' / 6'	1'	4	NT	La Marque	Garner
Custom Boat Mfg.	1649R	JB	30	2	16' / 6'	2'	1	NT	La Marque	Garner
Alumaweld	24	JB	40	2	24' / 6'	1.6	1	NT	La Marque	Garner
Broadhead	24	BAY	150	3	24' / 8'	2'	1	NT	La Marque	Garner
Alumaweld	1650	JB	25	2	16' / 6'	1'	5	NT	Port Arthur	Garner
Alumaweld	20	BAY	40	2	20' / 0'	2'	1	NT	Port Arthur	Garner
Alumaweld	1450	JB	25	2	14' / 0"	2"	1	NT	Port Arthur	Garner
Lobell	28'	BAY	200	3	28' / 8'	2'	1	NT	Port Arthur	Garner
Silver Ships	30'	BAY	400	3	30' / 8'	2	1	NT	Deer Park	Garner
Custom Boat Mfg.	1650	JB	25	2	16' / 6'	1'	6	NT	Deer Park	Garner
Duracraft	21'	LFB	40	3	21' / 6'	1'	1	NT	Deer Park	Garner
Pirogue	12'	OT	0	1	12' / 2"	3"	2	NT	Deer Park	Garner
Various	12'	JB	25	1	12' / 3"	1'	2	NT	Deer Park	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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SKIMMER TYPE CODES

FS	Floating Suction	HIP	Hydrodynamic Inclined Plane
IV	Induced Vortex	OB	Oleophilic Belt
OD	Oleophilic Disk	OR	Oleophilic Rod
PW	Paddle-Wheel	SK	Sock
W	Weir	OT	Other

SKIMMER EQUIPMENT

Name of Manufacturer	Model Number	Skimmer Type Code	Number of Units	Mfg. Recovery Rate (gpm)	Hose Size Suction/Discharge (inches)	Time to Deploy	Storage Location	Owner
Acme Products Co., Inc.	FS400ASK-39T	W	3	275	3.0	1.5	Deer Park	Garner
Douglas Engineering	4200SH Skim-Pak	FS	2	5 - 68	2.0	5	Deer Park	Garner
Crucial Inc.	1D18P-23	OT	3	25	2.0	.5	Deer Park	Garner
Crucial Inc.	1D18P-36	OT	5	36	2.0	.5	Deer Park	Garner
Marco	Sidewinder 14	OB	1	70	3.0	.5	Deer Park	Garner
Crucial Inc.	VSP-3"	W	2	550	3.0	1.5	Deer Park	Garner
Crucial Inc.	RF-Floating Head	W	1	200	3.0	1	Deer Park	Garner
Desmi	Mini Max	W	1	220	3.0	1	La Marque	Garner
Acme Products Co., Inc.	FS400ASK-39T	W	1	275	3.0	1.0	La Marque	Garner
Crucial Inc.	1D18P-23	OT	3	25	2.0	.5	La Marque	Garner
Acme Products Co., Inc.	FS400ASK-39T	W	1	275	3.0	.5	Port Arthur	Garner
Crucial Inc.	1D18P-36	OT	3	25	2.0	.5	Port Arthur	Garner
Elastec	Double Drum	OT	1	60	2.0	.5	Port Arthur	Garner
Douglas Engineering	4200SH Skim-Pak	FS	2	5 - 68	2.0	.5	Deer Park	Garner
Marco	Sidewinder 14	OB	1	70	3.0	.5	Deer Park	Garner
Marco	Harbor 28	OB	1	70	2.0	.5	Deer Park	Garner
Elastec	Mini Max, 20"	OT	1	20	2.0	1.	Deer Park	Garner

Corporate	Response Equipment Listing	Equipment Listing
Operations		Rev. December 2011

PU	Portable Vacuum Pump Units	D	Diesel
SS	Super Sucker	E	Electric
VT	Vacuum Truck	G	Gasoline
OT	Other	H	Hydraulic
		P	Pneumatic
		OT	Other

VACUUM SYSTEM EQUIPMENT										
Name of Manufacturer	Model Number	System Type Code	Drive Type Code	Suction (inches)	Number of Units	Mfg. Recovery Rate (gpm)	Storage Capacity (gallon)	Hose Invent (feet)	Storage Location	Owner
Safety Vac	449222	OT	D	14	1	40	150	200	Deer Park	Garner
Keith/Huber	LN8000	VT	D	27.0	6	80	3000	3200	La Marque	Garner
Ford	Meyers	OT	D		2	80	3000	500	La Marque	Garner
Super Products & Guzzler	5027	SS	D	27.0	1	450	3000	500	La Marque	Garner
Keith/Huber	LN8000	VT	D	27.0	1	80	3000	500	Port Arthur	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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SORBENT TYPE CODE		COMPOSITION CODE	
B	Boom	M	Mineral
PAD	Pad	NO	Natural
PT	Particulate	S	Organic
ST	Sheet	OT	Synthetic
SW	Sweep		Other
OT	Other		

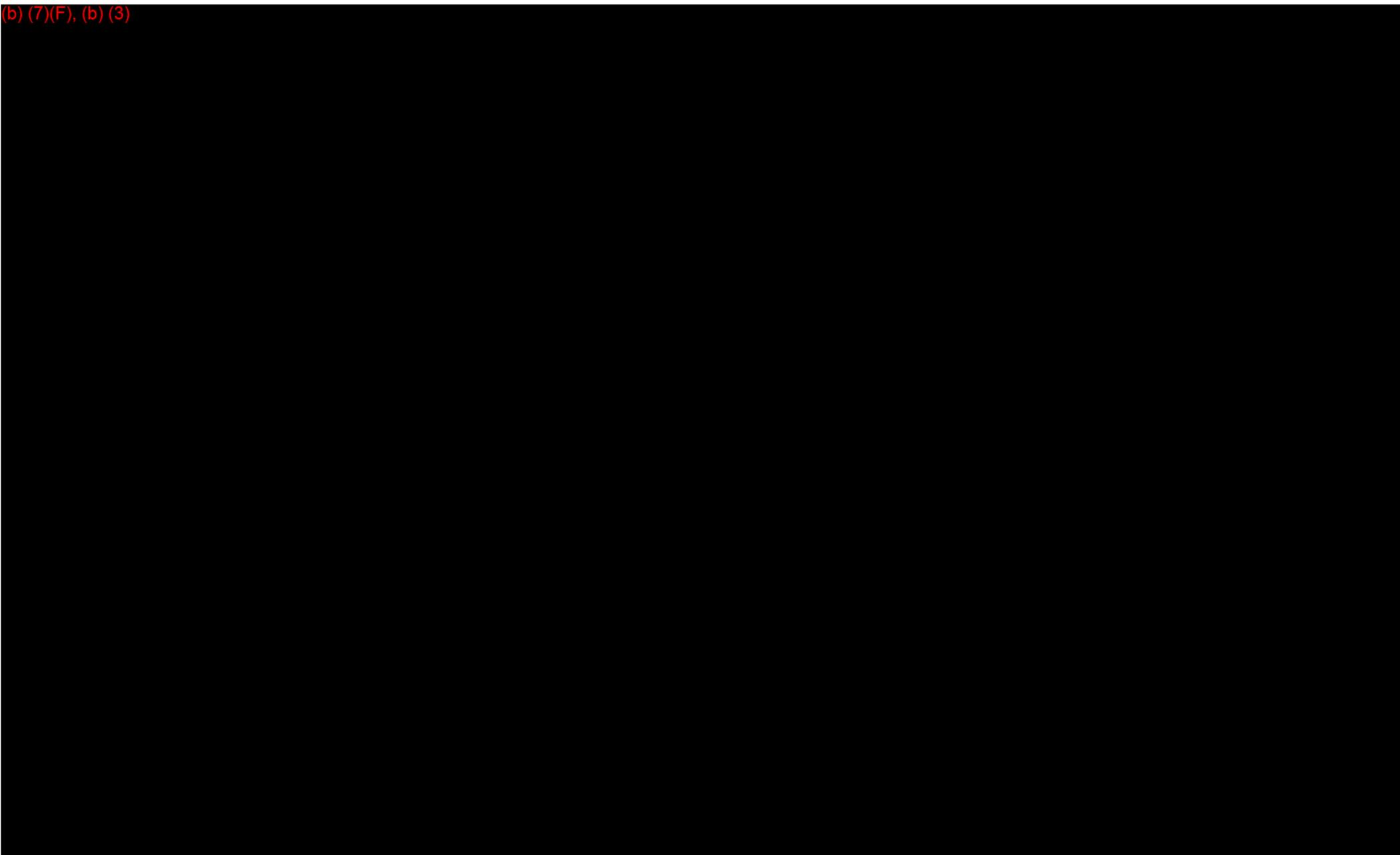
SORBENTS										
Name of Manufacturer	Model Number	Sorbent Type Code	Composition Type Code	Normal Inventory	Special Appl. Equip. Needed		Special Rcvg. Equip. Needed		Storage Location	Owner
					Yes	No	Yes	No		
Crucial, Inc.	OS-15	OT	S	1000		X		X	Deer Park	Garner
Complete Environmental Products	GES-P100	PAD	S	1000		X		X	Deer Park	Garner
Complete Environmental Products	GES-P200	PAD	S	250		X		X	Deer Park	Garner
Complete Environmental Products	GES-EP100	PAD	S	500		X		X	Deer Park	Garner
Complete Environmental Products	GES-P50	PAD	S	150		X		X	Deer Park	Garner
Complete Environmental Products	GES-B510	B	S	300		X		X	Deer Park	Garner
Complete Environmental Products	GES-B810	B	S	500		X		X	Deer Park	Garner
Complete Environmental Products	GES-R144	ST	S	150		X		X	Deer Park	Garner
Complete Environmental Products	GES-SW100	SW	S	300		X		X	Deer Park	Garner
Complete Environmental Products	GES-PART25	PT	S	10		X		X	Deer Park	Garner
Crucial, Inc.	OS-15	OT	S	150		X		X	La Marque	Garner
Complete Environmental Products	GES-P00	PAD	S	250		X		X	La Marque	Garner
Complete Environmental Products	GES-P200	PAD	S	100		X		X	La Marque	Garner
Complete Environmental Products	GES-P50	PAD	S	100		X		X	La Marque	Garner
Complete Environmental Products	GES-B510	B	S	100		X		X	La Marque	Garner
Complete Environmental Products	GES-B810	B	S	125		X		X	La Marque	Garner
Complete Environmental Products	GES-R144	ST	S	125		X		X	La Marque	Garner
Complete Environmental Products	GES-SW100	SW	S	150		X		X	La Marque	Garner
Complete Environmental Products	GES-PART25	P	S	10		X		X	La Marque	Garner

Corporate Operations	Response Equipment Listing	Equipment Listing Rev. December 2011
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SORBENTS										
Name of Manufacturer	Model Number	Sorbet Type Code	Composition Type Code	Normal Inventory	Special Appl. Equip. Needed		Special Rcvg. Equip. Needed		Storage Location	Owner
					Yes	No	Yes	No		
Crucial, Inc.	OS-15	OT	S	150		X		X	Port Arthur	Garner
Complete Environmental Products	GES-P100	PAD	S	100		X		X	Port Arthur	Garner
Complete Environmental Products	GES-P200	PAD	S	75		X		X	Port Arthur	Garner
Complete Environmental Products	GES-B510	B	S	100		X		X	Port Arthur	Garner
Complete Environmental Products	GES-B810	B	S	50		X		X	Port Arthur	Garner
Complete Environmental Products	GES-R144	ST	S	25		X		X	Port Arthur	Garner
Complete Environmental Products	GES-SW100	SW	S	50		X		X	Port Arthur	Garner
Crucial, Inc.	OS-15	OT	S	250		X		X	Deer Park	Garner
Complete Environmental Products	GES-P100	PAD	S	325		X		X	Deer Park	Garner
Complete Environmental Products	GES-P200	PAD	S	200		X		X	Deer Park	Garner
Complete Environmental Products	GES-EP100	PAD	S	500		X		X	Deer Park	Garner
Complete Environmental Products	GES-B510	B	S	100		X		X	Deer Park	Garner
Complete Environmental Products	GES-B810	B	S	150		X		X	Deer Park	Garner
Complete Environmental Products	GES-R144	ST	S	50		X		X	Deer Park	Garner
Complete Environmental Products	GES-SW100	SW	S	100		X		X	Deer Park	Garner

Figure 3-9 Texas GLO Staged Equipment

(b) (7)(F), (b) (3)



ATTACHMENT E-1 --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

GROUP 1

Part I Background Information

(b) (7)(F), (b) (3)

Step (A) Calculate Worst Case Discharge in barrels (Appendix D)

(A)

Step (B) Oil Group¹ (Table 3 and section 1.2 of this appendix)

1

Step (C) Operating Area (choose one)

Nearshore/Inland
Great Lakes

or Rivers
and Canals

Step (D) Percentages of Oil (Table 2 of this appendix)

Percent Lost to
Natural Dissipation

80

(D1)

Percent Recovered
Floating Oil

20

(D2)

Percent
Oil Onshore

10

(D3)

Step (E1) On-Water Oil Recovery $\frac{\text{Step (D2)} \times \text{Step (A)}}{100}$

Step (E2) Shoreline Recovery $\frac{\text{Step (D3)} \times \text{Step (A)}}{100}$. . .

Step (F) Emulsification Factor
(Table 3 of this appendix)

(b) (7)(F), (b) (3)

Step (G) On-Water Oil Recovery Resource Mobilization Factor
(Table 4 of this appendix)

Tier 1

Tier 2

Tier 3

(b) (7)(F), (b) (3)

(G1)

(G2)

(G3)

¹ A facility that handles, stores, or transports multiple groups of oil must do separate calculations for each oil group on site except for those oil groups that constitute 10 percent or less by volume of the total oil storage capacity at the facility. For purposes of this calculation, the volumes of all products in an oil group must be summed to determine the percentage of the facility's total oil storage capacity.

ATTACHMENT E-1 (CONTINUED) --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

GROUP 1

Part II On-Water Oil Recovery Capacity (barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

Part III Shoreline Cleanup Volume (barrels)

(b) (7)(F), (b) (3)
Step (E2) x Step (F)

Part IV On-Water Response Capacity By Operating Area
(Table 5 of this appendix)
(Amount needed to be contracted for in barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

Part V On-Water Amount Needed to be Identified, but not Contracted for in Advance (barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

NOTE: To convert from barrels/day to gallons/day, multiply the quantities in Parts II through V by 42 gallons/barrel.

ATTACHMENT E-1 --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

GROUP 2

Part I Background Information

Step (A) Calculate Worst Case Discharge in barrels (Appendix D)

(b) (7)(F), (b) (3)
[Redacted]

(A)

Step (B) Oil Group¹ (Table 3 and section 1.2 of this appendix)

2

Step (C) Operating Area (choose one)



Nearshore/Inland
Great Lakes



or Rivers
and Canals

Step (D) Percentages of Oil (Table 2 of this appendix)

Percent Lost to
Natural Dissipation

Percent Recovered
Floating Oil

Percent
Oil Onshore

50

50

30

(D1)

(D2)

(D3)

Step (E1) On-Water Oil Recovery $\frac{\text{Step (D2)} \times \text{Step (A)}}{100}$

100

Step (E2) Shoreline Recovery $\frac{\text{Step (D3)} \times \text{Step (A)}}{100}$. . .

100

Step (F) Emulsification Factor

(Table 3 of this appendix)

(b) (7)(F), (b) (3)
[Redacted]

Step (G) On-Water Oil Recovery Resource Mobilization Factor

(Table 4 of this appendix)

Tier 1

Tier 2

Tier 3

0.15

0.25

0.40

(G1)

(G2)

(G3)

¹ A facility that handles, stores, or transports multiple groups of oil must do separate calculations for each oil group on site except for those oil groups that constitute 10 percent or less by volume of the total oil storage capacity at the facility. For purposes of this calculation, the volumes of all products in an oil group must be summed to determine the percentage of the facility's total oil storage capacity.

ATTACHMENT E-1 (CONTINUED) --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

GROUP 2

Part II On-Water Oil Recovery Capacity (barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

Part III Shoreline Cleanup Volume (barrels)

(b) (7)(F), (b) (3)
Step (E2) X Step (F)

Part IV On-Water Response Capacity By Operating Area
(Table 5 of this appendix)
(Amount needed to be contracted for in barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

Part V On-Water Amount Needed to be Identified, but not Contracted for in Advance (barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

NOTE: To convert from barrels/day to gallons/day, multiply the quantities in Parts II through V by 42 gallons/barrel.

ATTACHMENT E-1 --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

GROUP 3

Part I Background Information

Step (A) Calculate Worst Case Discharge in barrels (Appendix D)

(b) (7)(F), (b) (3)

Step (B) Oil Group¹ (Table 3 and section 1.2 of this appendix)

3

Step (C) Operating Area (choose one)

Nearshore/Inland
Great Lakes

or Rivers
and Canals

Step (D) Percentages of Oil (Table 2 of this appendix)

Percent Lost to
Natural Dissipation

Percent Recovered
Floating Oil

Percent
Oil Onshore

30

50

50

(D1)

(D2)

(D3)

Step (E1) On-Water Oil Recovery $\frac{\text{Step (D2)} \times \text{Step (A)}}{100}$

100

Step (E2) Shoreline Recovery $\frac{\text{Step (D3)} \times \text{Step (A)}}{100}$. .

100

Step (F) Emulsification Factor

(Table 3 of this appendix)

(b) (7)(F), (b) (3)

Step (G) On-Water Oil Recovery Resource Mobilization Factor
(Table 4 of this appendix)

Tier 1

Tier 2

Tier 3

0.15

0.25

0.40

(G1)

(G2)

(G3)

¹ A facility that handles, stores, or transports multiple groups of oil must do separate calculations for each oil group on site except for those oil groups that constitute 10 percent or less by volume of the total oil storage capacity at the facility. For purposes of this calculation, the volumes of all products in an oil group must be summed to determine the percentage of the facility's total oil storage capacity.

ATTACHMENT E-1 (CONTINUED) --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

GROUP 3

Part II On-Water Oil Recovery Capacity (barrels/day)

Tier 1

Tier 2

Tier 3

(b) (7)(F), (b) (3)

Part III Shoreline Cleanup Volume (barrels)

(b) (7)(F), (b) (3)

Part IV On-Water Response Capacity By Operating Area
(Table 5 of this appendix)
(Amount needed to be contracted for in barrels/day)

Tier 1

Tier 2

Tier 3

(b) (7)(F), (b) (3)

Part V On-Water Amount Needed to be Identified, but not Contracted for in Advance (barrels/day)

Tier 1

Tier 2

Tier 3

(b) (7)(F), (b) (3)

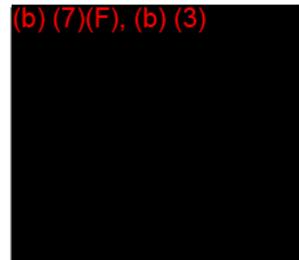
NOTE: To convert from barrels/day to gallons/day, multiply the quantities in Parts II through V by 42 gallons/barrel.

GROUP 4

ATTACHMENT E-1 --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

Part I Background Information

Step (A) Calculate Worst Case Discharge in barrels (Appendix D)



Step (B) Oil Group¹ (Table 3 and section 1.2 of this appendix)

Step (C) Operating Area (choose one) Nearshore/Inland Great Lakes or Rivers and Canals

Step (D) Percentages of Oil (Table 2 of this appendix)

Percent Lost to Natural Dissipation	Percent Recovered Floating Oil	Percent Oil Onshore
10	50	70
(D1)	(D2)	(D3)

Step (E1) On-Water Oil Recovery $\frac{\text{Step (D2)} \times \text{Step (A)}}{100}$

Step (E2) Shoreline Recovery $\frac{\text{Step (D3)} \times \text{Step (A)}}{100}$. .

Step (F) Emulsification Factor (Table 3 of this appendix)



Step (G) On-Water Oil Recovery Resource Mobilization Factor (Table 4 of this appendix)

Tier 1	Tier 2	Tier 3
0.15	0.25	0.40
(G1)	(G2)	(G3)

¹ A facility that handles, stores, or transports multiple groups of oil must do separate calculations for each oil group on site except for those oil groups that constitute 10 percent or less by volume of the total oil storage capacity at the facility. For purposes of this calculation, the volumes of all products in an oil group must be summed to determine the percentage of the facility's total oil storage capacity.

GROUP 4

ATTACHMENT E-1 (CONTINUED) --
WORKSHEET TO PLAN VOLUME OF RESPONSE RESOURCES
FOR WORST CASE DISCHARGE

Part II On-Water Oil Recovery Capacity (barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

Part III Shoreline Cleanup Volume (barrels)

(b) (7)(F), (b) (3)

Part IV On-Water Response Capacity By Operating Area
(Table 5 of this appendix)
(Amount needed to be contracted for in barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

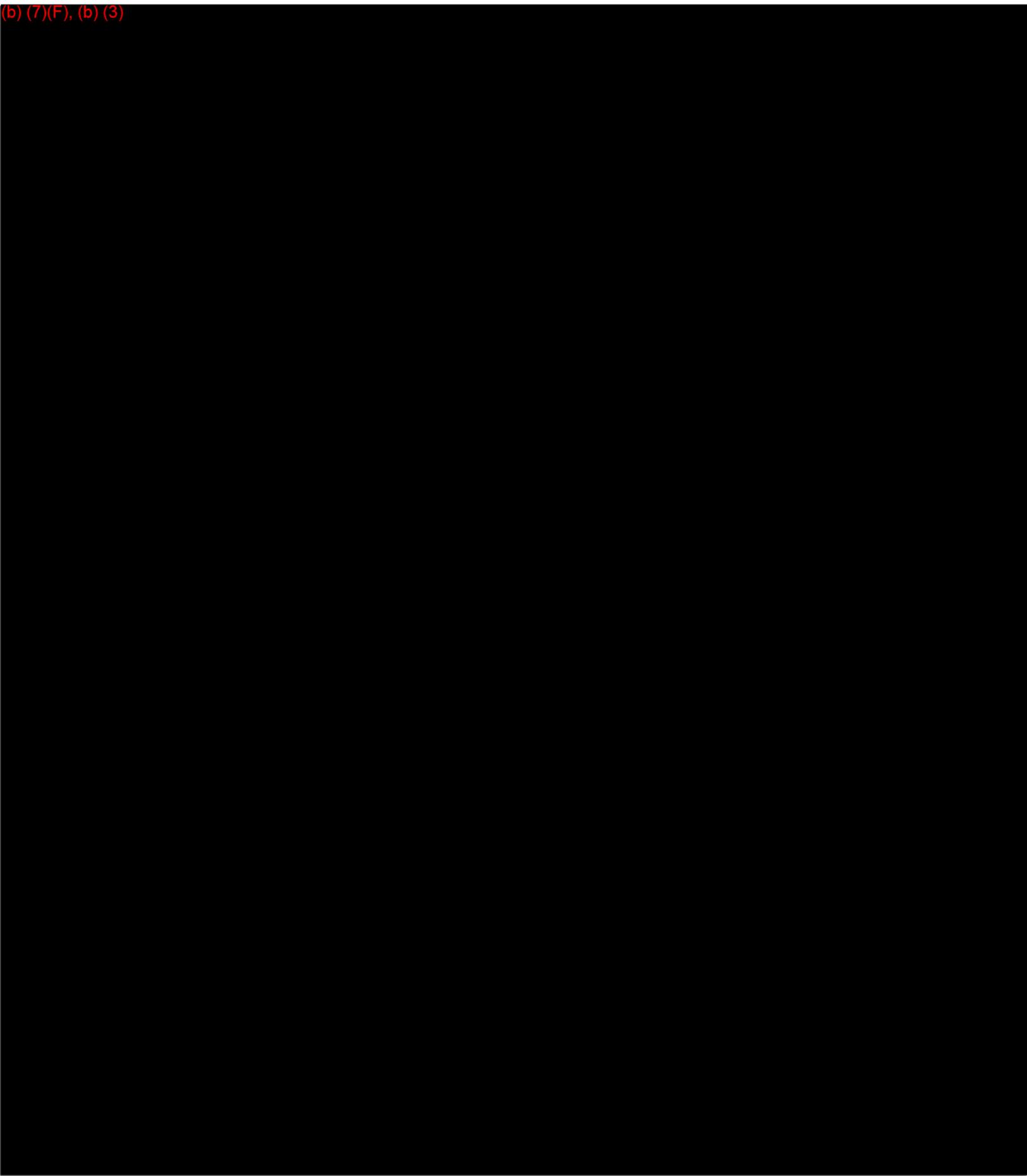
Part V On-water Amount Needed to be Identified, but not Contracted for in Advance (barrels/day)

Tier 1	Tier 2	Tier 3
(b) (7)(F), (b) (3)		

NOTE: To convert from barrels/day to gallons/day, multiply the quantities in Parts II through V by 42 gallons/barrel.

Calculations for DOT Pipeline Worst Case Spill

(b) (7)(F), (b) (3)





LEGEND

ENVIRONMENTAL SENSITIVITY INDEX

- MANGROVE MARSH (10D)
- FRESHWATER SWAMPS (10C)
- FRESHWATER MARSHES (10B)
- SALT AND BRACKISH MARSHES (10A)
- SHELTERED TIDAL FLATS (9)
- SHELTERED ROCKY/KARST SHORES (8D)
- SHELTERED SCARPS (8C)
- SHELTERED RIPRAP STRUCTURES (8B)
- SHELTERED SOLID MAN-MADE STRUCTURES (8A)
- EXPOSED TIDAL FLATS (7)
- EXPOSED RIPRAP STRUCTURES (6B)
- GRAVEL OR SHELL BEACHES (6A)
- MIXED SAND AND GRAVEL OR SHELL BEACHES (5)
- COARSE-GRAINED SAND BEACHES (4)
- SCARPS AND STEEP SLOPES IN SAND (3B)
FINE-GRAINED SAND BEACHES (3A)
- WAVE-CUT CLAY PLATFORMS (2B)
SCARPS AND STEEP SLOPES IN CLAY (2A)
- EXPOSED WALLS AND OTHER SOLID STRUCTURES (1)

HYDROGRAPHY

- MARSH, WETLAND
- TIDAL, MUD OR SAND FLATS
- BEACH, BAR
- INTERMITTENT WATER BODY
- DUNES
- SUBMERGED AQUATIC VEGETATION
- MANGROVES
- OYSTERS

PRIORITY PROTECTION AREAS

- HIGH MEDIUM
- MEDIUM PRIORITY
- LOW PRIORITY

BIOLOGICAL RESOURCES

- DIVING BIRDS
- GULLS/TERNS
- PASSERINE BIRDS
- PELAGIC BIRDS
- RAPTORS
- SHOREBIRDS
- WADING BIRDS
- WATERFOWL
- FISH
- DOLPHINS
- SMALL MAMMALS
- UPLAND/WETLAND PLANTS
- SUBMERGED AQUATIC VEGETATION
- ALLIGATOR
- TURTLES
- OTHER REPTILES/AMPHIBIANS
- BIVALVES
- CRABS
- GASTROPODS
- SHRIMP
- SQUID
- THREATENED/ENDANGERED SPECIES

POLITICAL BOUNDARIES

- COUNTY BOUNDARY
- MUNICIPAL BOUNDARY

TRANSPORTATION

- DIVIDED HIGHWAY
- STATE/FEDERAL HIGHWAY
- CITY STREET/COUNTY ROAD
- AIRPORT
- RAILROAD
- SHIP CHANNEL/GULF INTRACOASTAL WATERWAY
- SHIPPING SAFETY FAIRWAY

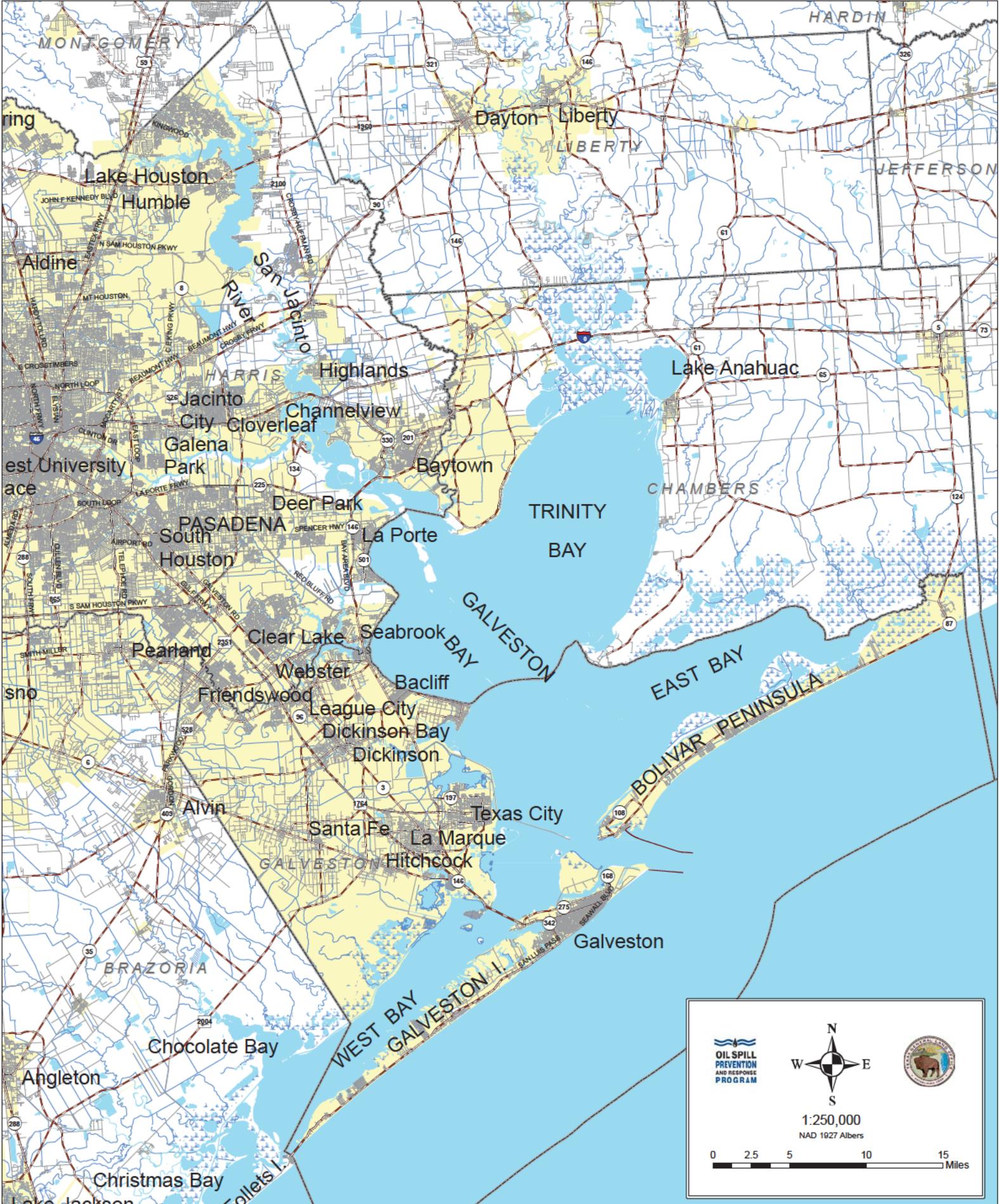
HUMAN USE FEATURES

- AQUACULTURE SITE
- BEACH ACCESS POINT
- BOAT RAMP
- COAST GUARD STATION
- HELIPORT
- LIGHTHOUSE
- MARINA
- WATER INTAKE POINT

OTHER LAYERS

- ANCHORAGE AREA
- AUDUBON SANCTUARY
- BIRD ROOKERY AREA
- CITY OR COUNTY PARK
- COASTAL PRESERVE
- MUNICIPAL AREA
- NATIONAL WILDLIFE REFUGE
- STATE PARK/WILDLIFE MANAGEMENT AREA
- WASHOVER AREA

Galveston Bay Area

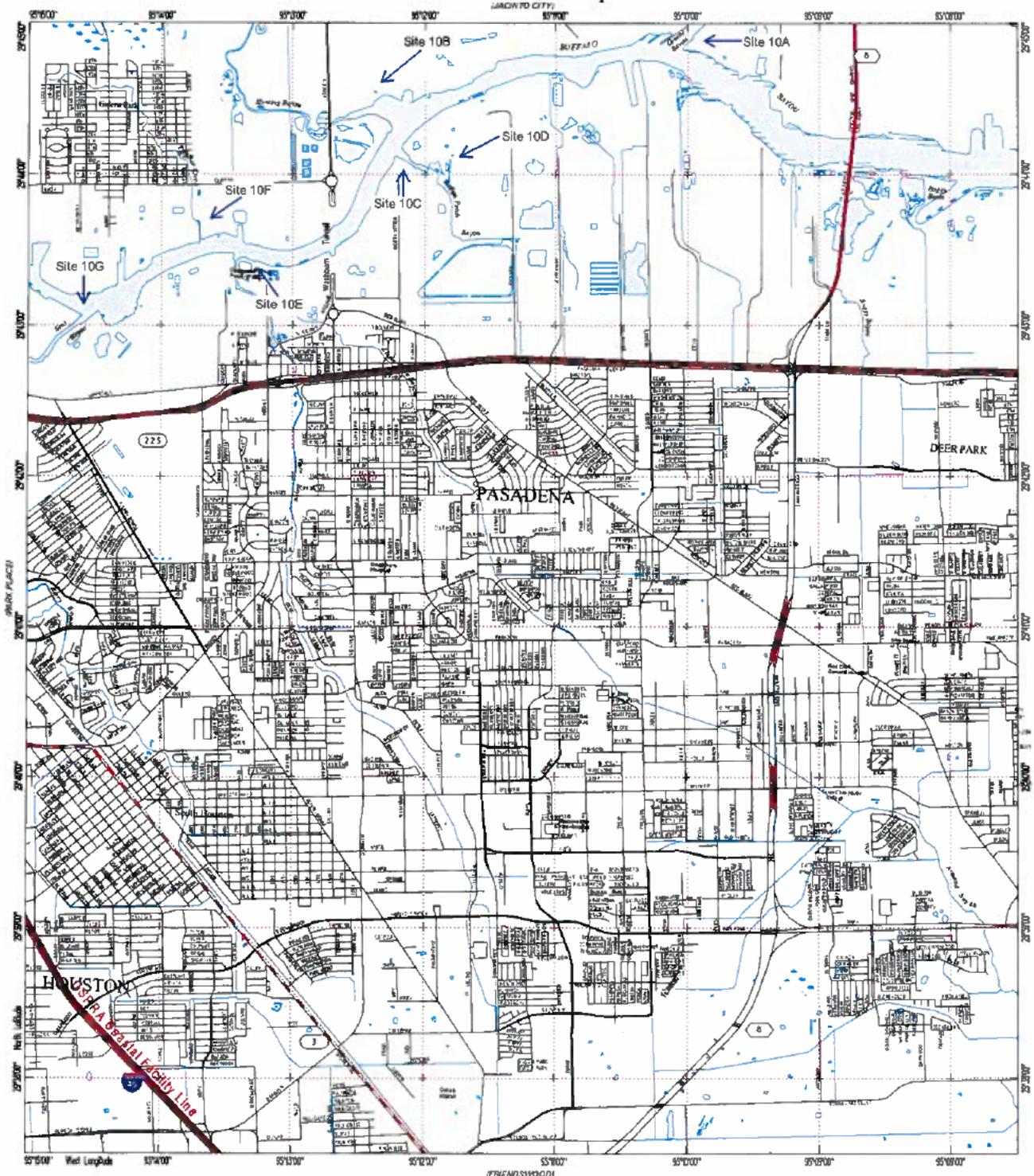


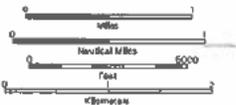
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NAD 1927 Albers

0 2.5 5 10 15 Miles

Pasadena Base Map



2995-413



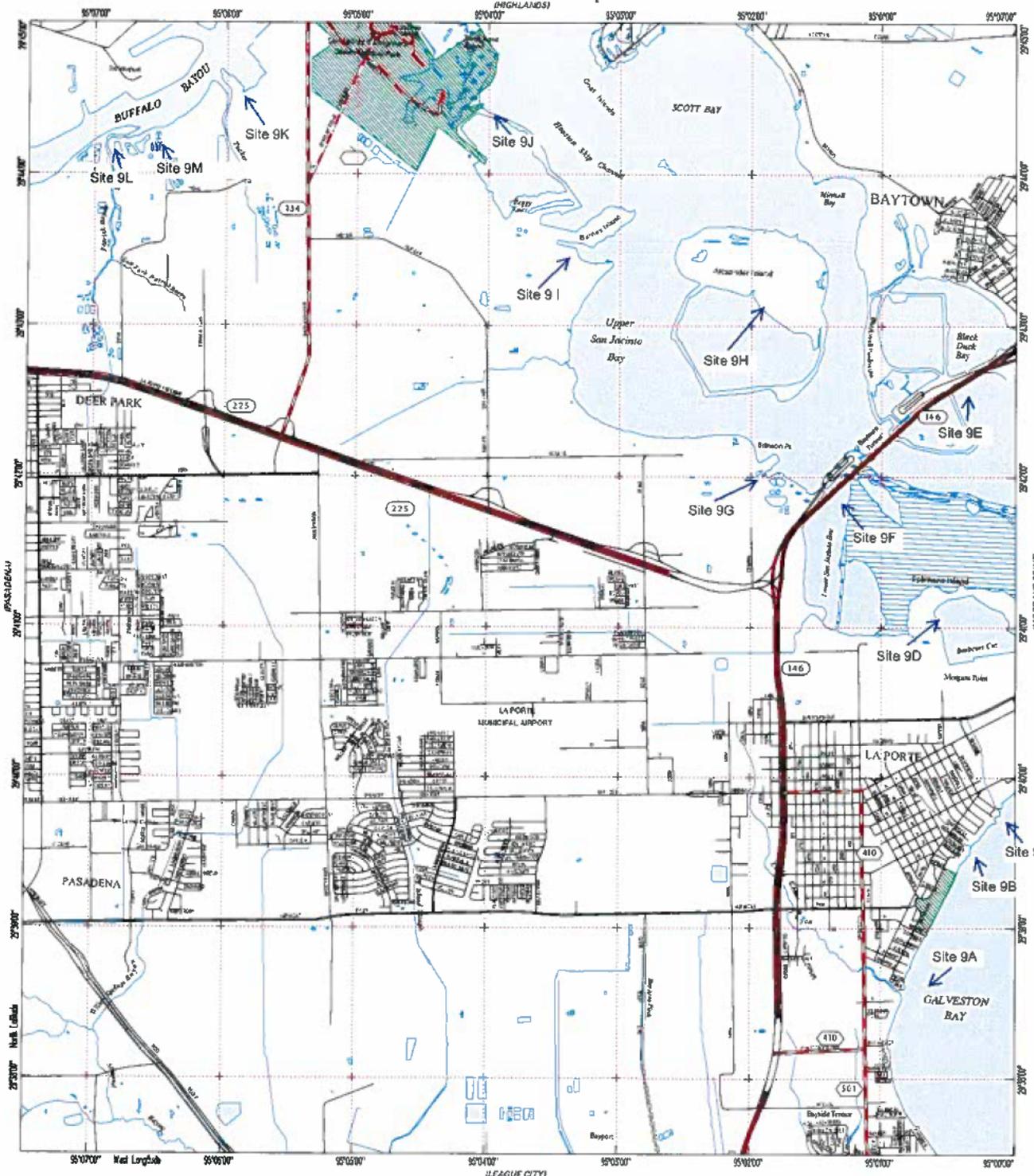
[View Pasadena Response Map](#)

[View all Pasadena Site Specific Plans](#)

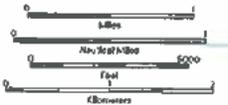
Map Legend

- Lake, Bay, River
- Marsh, Wetland, Swamp
- Flats, Mud, Sand, Tidal
- Divided Highway
- State/Federal Highway
- City/County Road

La Porte Base Map



2996-414



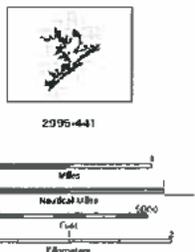
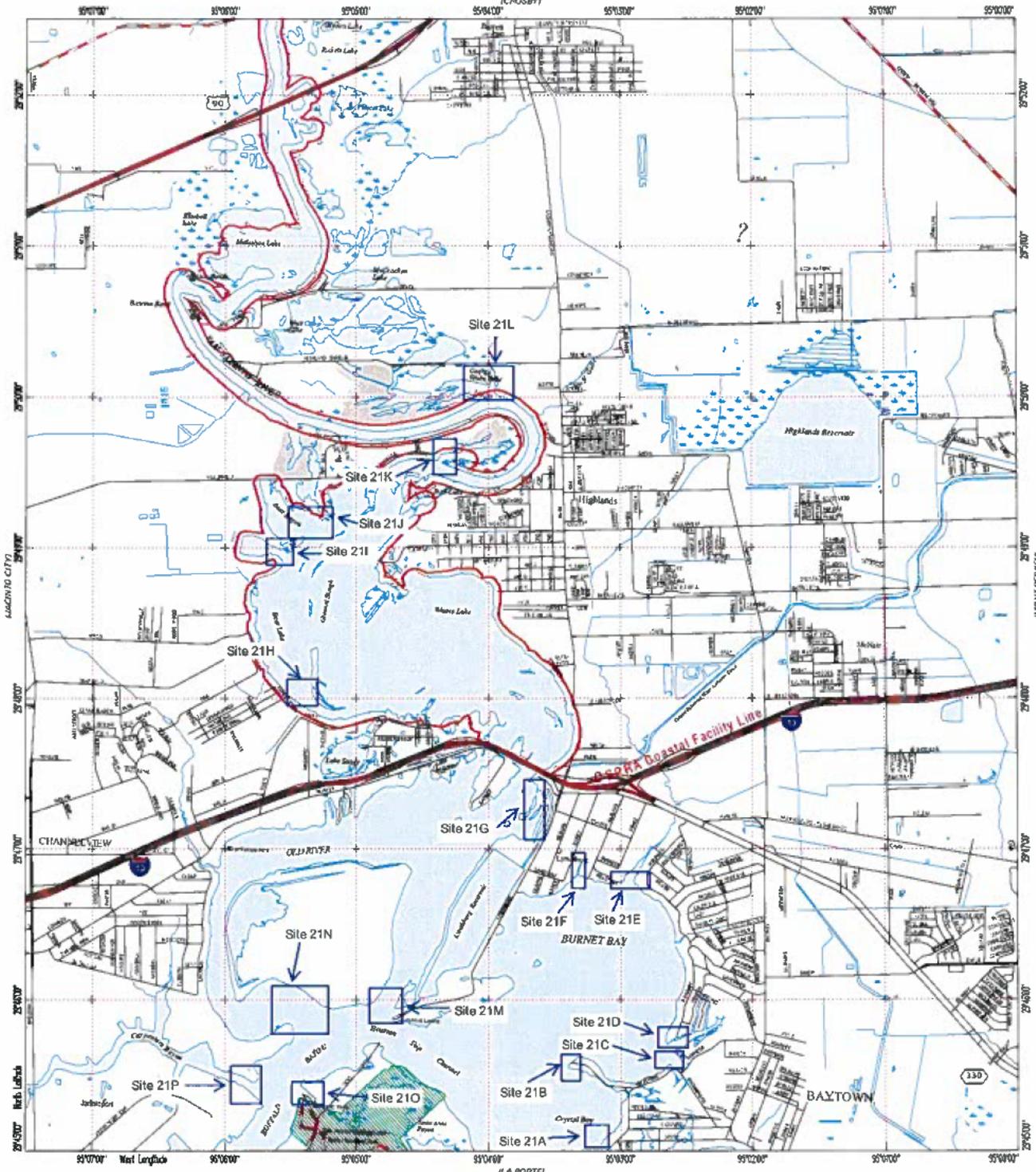
[View La Porte Response Map](#)
[View all LaPorte Site Specific Plans](#)

Map Legend

- Lake, Bay, River
- Marsh, Wetland, Swamp
- Flats (Mud, Sand, Tidal)
- Conservation Area
- Divided Highway TxDOT
- State/Federal Highway TxDOT
- City Street/County Road TxDOT

Highlands Base Map

(CROSSP)



[View Highlands Response Map](#)
[View all Highlands Site Specific Plans](#)

- Map Legend**
- Lake, Bay, River
 - Marsh, Wetlands, Swamp
 - Mine (Mud, Sand, Tidal)
 - Conservation Area
 - Divided Highway T-DOE
 - State/Federal Highway T-DOE
 - City/Street/County Road T-DOE
 - OSPRA Coastal Facility Designation Line GLO

Figure 5.2 Response Resource Operating Criteria of Oil Recovery Devices

<u>Operating Environment</u>	<u>Significant Wave Height</u>	<u>Sea State</u>
River	≤1 foot	1
Inland	≤3 feet	2
Great Lakes	<4 feet	2-3
Ocean	≤6 feet	3-4

Boom Use

<u>Boom Property</u>	<u>River</u>	<u>Inland</u>	<u>Great Lakes</u>	<u>Ocean</u>
Significant Wave Height	<1	<3	<4	<6
Sea State	1	2	2-3	3-4
Boom height-in.(draft) + freeboard	10-18	18-42	18-42	≥42
Reserve Buoyancy to Weight Ratio	2:1	2:1	2:1	3:1 to 4:1
Total Tensile Strength (lbs)	4,500	15-20,000	15-20,000	≥20,000
Skirt Fabric Tensile Strength (lbs)	200	300	300	500
Skirt Fabric Tear Strength (lbs)	100	100	100	125

Emulsification Factors for Oil Product Groups

NON-PERSISTENT OIL

Group 1 1.0

PERSISTENT OIL

Group 2 1.8

Group 3 2.0

Group 4 1.4

Group 5 1.0

Response Resource Operating Criteria of Oil Recovery Devices

<u>Operating Area</u>	<u>Tier 1</u>	<u>Tier 2</u>	<u>Tier 3</u>
River & Canals	.30	.40	.60
Inland / Near shore /Great Lakes	.15	.25	.40
Offshore	.10	.165	.21

Note: These mobilization factors are for total resources mobilized, not incremental resources.

Response Capability Caps By Geographic Area (Thousand Barrels/Day)

<u>February 18, 1993</u>	<u>Tier 1</u>	<u>Tier 2</u>	<u>Tier 3</u>
All except rivers, canals, Great Lakes	10K	20K	40K
Great Lakes	5K	10K	20K
Rivers & Canals	1.5K	3K	6K
<u>February 18, 1998</u>			
All except rivers, canals, & Great Lakes	12.5K	25K	50K
Great Lakes	6.35K	12.3K	25K
Rivers & Canals	1.875K	3.75K	7.5K
<u>February 18, 2003</u>	TBD	TBD	TBD

Note: The caps show cumulative overall effective daily recovery rate, not incremental increases. This table updated to conform to EPA Final Rule 40 CFR 112, September 26, 1994.

Removal Capacity Planning Table

Spill Location	Near shore / Inland			Rivers and Canals		
Sustainable On-Water Recovery	4 days			3 days		
Oil Group	% Natural Dissipation	% Recovered Floating Oil	% Oil Onshore	% Natural Dissipation	% Recovered Floating Oil	% Oil Onshore
1. Non-persistent Oils	80	20	10	80	10	10
2. Light Crudes and Fuels	50	50	30	40	15	45
3. Medium Crudes and Fuels	30	50	50	20	15	65
4. Heavy Crudes and Fuels*	10	50	70	5	20	75

* For planning purposes, non-petroleum oil must be considered a Group 4 persistent oil.

Response Resource Operating Criteria of Oil Recovery Devices

Revised USCG OSRO Classifications (as of 31 October 1996)

The USCG has classified OSROs according to their response capabilities, within each Captain of the Port (COTP) zone, for vessels and for facilities in four types of environments. Response capabilities are rated A, B, C, D, or E as described below.

Minimum Equipment Requirements for OSRO Classifications

Classification	Resource Quantity Guidelines	Maximum Facility Response Times	Maximum Vessel Response Time
Rivers/Canals			
A	Boom: 2,000 EDRC: 50 bb TSC: 100 bb	Boom Deployment: 1 hour EDRC/TSC: 2 hours	Boom Deployment: 1 hour EDRC/TSC: 2 hours
B	Containment Boom 4,000 Protective Boom 4,000 EDRC: 1,250 bb TSC: 2,500 bb	High Volume Port: 6 hours Other Ports: 12 hours	High Volume Port: 12 hours Other Ports: 24 hours
C ⁴	Containment Boom 4,000 Protective Boom 10,000 EDRC: 1,500 bb TSC: 3,000 bb	High Volume Port: 6 hours Other Ports: 12 hours	High Volume Port: 12 hours Other Ports: 24 hours
D ⁴	Containment Boom 4,000 Protective Boom 16,000 EDRC: 3,000 bb TSC: 6,000 bb	High Volume Port: 30 hours Other Ports: 36 hours	High Volume Port: 36 hours Other Ports: 48 hours
E ⁴	Containment Boom 4,000 Protective Boom 22,000 EDRC: 6,000 bb TSC: 12,000 bb	High Volume Port: 54 hours Other Ports: 60 hours	High Volume Port: 60 hours Other Ports: 72 hours
Great Lakes			
A	Boom: 2,000 EDRC: 50 bb TSC: 100 bb	Boom Deployment: 1 hour EDRC/TSC: 2 hours	Boom Deployment: 1 hour EDRC/TSC: 2 hours
B	Containment Boom 6,000 Protective Boom 6,000 EDRC: 1,250 bb TSC: 2,500 bb	All Ports: 6 hours	All Ports: 12 hours
C ⁴	Containment Boom 12,000 Protective Boom 12,000 EDRC: 5,000 bb TSC: 10,000 bb	All Ports: 12 hours	All Ports: 18 hours
D ⁴	Containment Boom 18,000 Protective Boom 18,000 EDRC: 10,000 bb TSC: 20,000 bb	All Ports: 36 hours	All Ports: 42 hours
E ⁴	Containment Boom 24,000 Protective Boom 24,000 EDRC: 20,000 bb TSC: 40,000 bb	All Ports: 60 hours	All Ports: 66 hours

Response Options for Substances with Properties Similar to Oil

Mechanism	River Bank	Man-made Shore	Dredge Spoil Bank	Marsh
Protection				
Booms/Skimmers	P	P	P	P
Ditches/dikes	O		O	
Herding	O	O	O	O
Cleaning/Mixing				
Burning	X	X		XX
Mixing			O	
Natural Cleaning	P	P	P	P
Removal/Disposal				
Manual Removal	P	O	O	XX
Mechanical Removal	O		O	XX
Vacuum Pumping	O			O
Vegetation Cropping				X
Onshore Dispersion				
Dispersants (on shore)**		O		O
High-pressure flushing		O		XX
Low-pressure flushing	O	P		P
Sand Blasting		O		
Steam Cleaning		O		XX
<p>P = Preferred</p> <p>O = Optional</p> <p>X = Not advisable</p> <p>XX = Avoid</p> <p>* Texas Water Commission, Spill Response Map Series, Coastal Region</p> <p>** A federal on-scene coordinator may authorize dispersant use only with the concurrence of all members of the EPA Region VI Response Team</p>				

MATERIAL SAFETY DATA SHEETS

MSDS No.	Material Description
AP0011	Gasoline
AP0012	Ultra-low Sulfur Diesel
AP0104	Alkylate
AP0106	Isobutane (High Purity)
AP0126	Isopentane
AP0152	Toluene Stock Blend
AP0184	B.T. Raffinate
AP0185	Light Fluid Gasoline
AP0187	Heavy Fluid Gasoline
AP0248	Vacuum Gas Oil (VGO)
AP0270	Kerosene (Jet Fuel)
AP0381	Coker Feed (High Sulfur)
AP0827	Isobutane – Refinery Grade
AP0828	Normal Butane
AP0834	Coke
AP0845	Sulfur (Molten)
AP0878	B-B Stock
AP0881	Heavy Cycle Oil (HCO)
AP0883	Light Gas Oil (LGO)
AP0884	Heavy Straight Run Naphtha
AP0885	Coker Naphtha
AP0888	Heavy Reformate
AP1159	Depentanized Coker Naphtha
AP1595	Disulfide Oil (DSO)
AP1828	Coker Light Gas Oil (CLGO)
AP2050	Light Cycle Oil (LCO)
AP2899	Toluene – Commercial Grade
AP3583	OP-400 Naphtha
AP3739	Coker Gas Oil (CGO)
AP3807	Reformer Feed
AP3912	Full-Range Pyrolysis Naphtha
AP7594	Benzene
RS0003	Hydrogen-Rich Sweet Refinery Gas
RS0004	Refinery Fuel Gas
RS0005	Methane- Hydrogen-Rich Sweet Refinery Gas

MATERIAL SAFETY DATA SHEETS

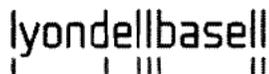
MSDS No.	Material Description
RS0011	Sulfur Plant Feed from Sour Water Strippers
RS0015	Acid Scrubber Off Gas
RS0018	Sour Refinery Gas
RS0019	Hydrogen-Rich Sour Refinery Gas (C1-C4)
RS0022	Vent Waste Sour Gas (C1-C6)
RS0023	Hydrogen-Rich Sour Refinery Gas (C1-C6)
RS0025	Mixed Refinery Gas with Hydrogen (C1-C6)
RS0026	OP-730 Feed
RS0029	OP-700 Feed
RS0031	Reformate Gas-Hydrogen Rich (C1-C6)
RS0032	Sour LPG with Methyl Mercaptans
RS0033	Sour Refinery Gas with Methyl Mercaptans (C1-C6)
RS0038	Sulfur Plant Gas
RS0041	Light Overhead Liquids
RS0042	FCCU Sour Propane-Propylene
RS0043	Propylene – FCCU Grade
RS0044	BRU No.2 Deisobutanizer Tower OH
RS0045	BRU No.2 Stabilizer Tower OH
RS0046	637 HDS Feed
RS0047	637 Reactor Feed
RS0048	637 Reactor Effluent
RS0051	Thermocracked Tail Gas (C1-C5)
RS0052	Reformate Gas (C2-C6)
RS0053	Pentane-Rich Petroleum Ether (C4-C6)
RS0054	Stabilizer Tower Bottoms
RS0055	N-Butane to Caustic Treaters
RS0056	Full-Range Hydrotreated Naphtha
RS0057	Sour Butane-Butene Feed to BB Extractor Preheater
RS0058	BTU Recycle Gas
RS0060	Coker Naphtha Splitter OH
RS0061	Feed to BB Extractor and BB Settler
RS0062	Feed to PP Caustic Treater and Wash Drum
RS0063	Depentanizer Tower OH Gas
RS0066	Stripper OH
RS0067	Sour Vent Gas

MATERIAL SAFETY DATA SHEETS

MSDS No.	Material Description
RS0071	Sulfidic Caustic Solution
RS0072	Slop Oil
RS0102	Heavy Thermocracked Naphtha
RS0112	Light Hydrodesulfurized Naphtha
RS0113	Heavy Hydrodesulfurized Naphtha
RS0114	Straight-Run Naphtha (C4-C11)
RS0116	FCCU Raw Gasoline
RS0119	Naphtha H2 Mixed-Phase Reformate
RS0120	Sour Naphtha Mixed Phase Refinery Stream
RS0122	Full-Range Reformate Naphtha (C4-C12)
RS0124	Light Straight-Run Naphtha (C4-C10)
RS0127	Sour Hydrodesulfurized Naphtha
RS0132	BTU Depentanizer Tower Bottoms
RS0142	Depentanizer OH Accumulator Liquid
RS0151	Light Aromatic Solvent Naphtha (C8-C11)
RS0156	Light Naphtha Solvent Extract (C6-C8)
RS0160	Sour LPG Light Naphtha LEF OH Feed to BTU
RS0165	Benzene NESHAP Stripper Tower OH
RS0166	B.T. Reformer Feed
RS0167	BTU C8 Splitter OH
RS0206	Kerosene Straight-Run (C9-C16)
RS0208	Vacuum Tower Condensate (C11-C25)
RS0252	Straight-Run Middle Distillate (C11-C20)
RS0258	Atmospheric Gas Oil (AGO)
RS0262	Sour Intermediate Distillate Hydrogen Mixed Phase Stream
RS0265	Atmospheric Tower Light Gas Oil (ALGO)
RS0305	FCCU Fresh Feed
RS0401	Thermocracker Coker Bottoms
RS0402	Vacuum Tower Bottoms
RS0405	Atmospheric Tower Bottoms
RS0501	FCCU Fractionator Feed
RS0904	Stripped Sour Water
RS0911	Oily Wastewater
RS0914	Sour Water from Crude Units
RS0915	Sour Water

MATERIAL SAFETY DATA SHEETS

MSDS No.	Material Description
RS0921	Recovered Light Slop Oil from Wastewater Plant
RS0922	Benzene NESHAP Stripper Tower Feed
RS0951	Rich DEA
RS0952	Lean DEA
RS0963	Light Aromatics with Sulfolane
RS0968	Lean MDEA
RS0969	Rich MDEA
RS0975	Merox Rich Caustic
RS0986	No. 2 Depropanizer Bottoms
RS0990	Kerosene with DSO
RS0992	Heavy Hydrodesulfurized Naphtha (C7-C12)
RS1000	Refinery Heater Fuel Gas
RS6806	Merox Lift Station Hydrocarbon Caustic Stream



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

AP0011
 HER# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: GASOLINE

Number: 00000000000014944

Internal ID: AP0011, AP1250, PS2438, PS0148

Chemical characterization: Mixture

CAS-No.: 86290-81-5

Chemical Name: Hydrocarbons and additives

Synonyms: Petrol, Low boiling point naphtha, Low-octane motor gasoline, Gasoline all types, Gasoline with Ethanol (all grades), Conventional gasoline, RBOB

Use category: Motor Fuel (gasoline)

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

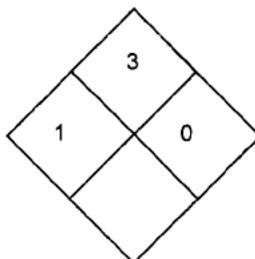
Signal Word

DANGER.

Hazards

Extremely flammable liquid. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. May cause eye and skin irritation. Respiratory tract irritant. Aspiration may cause lung damage. Exposure to vapor may cause central nervous system depression (fatigue, dizziness, headache, collapse, coma and death) and, possibly, cardiac sensitization. May affect hearing. Possible reproductive toxin. May cause developmental toxicity. Contains material which can cause cancer.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state

liquid



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Color

colorless to light yellow

Odor

Gasoline or naphtha odor.

Odor Threshold

No value available.

Potential health effects

Routes of exposure

Skin. Inhalation. Eye.

Acute effects

Skin

May produce skin irritation. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Inhalation

Can cause pulmonary edema if aspirated into lungs.

Eyes

May cause moderate irritation, including burning sensation, tearing, redness or swelling. Effects of eye irritation are reversible.

Ingestion

Aspiration may cause lung damage.

Chronic effects

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. Prolonged or repeated exposure to vapors may cause lung damage. May effect hearing. Suspect reproductive hazard. May cause developmental toxicity. Contains material which may cause cancer based on animal data.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Vol-%</u>
Gasoline	86290-81-5	289-220-8	85.0 <= 100.0
Toluene	108-88-3	203-625-9	1.0 <= 20.0
n-Pentane	109-66-0	203-692-4	5.0 <= 20.0
Xylene	1330-20-7	215-535-7	1.0 <= 18.0
Ethyl alcohol	64-17-5	200-578-6	0.0 <= 10.0
n-Hexane	110-54-3	203-777-6	1.0 <= 8.0
Methyl Cyclohexane	108-87-2	203-624-3	1.0 <= 5.0
Trimethyl benzene	25551-13-7	247-099-9	1.0 <= 5.0
Benzene	71-43-2	200-753-7	0.1 <= 5.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Cumene	98-82-8	202-704-5	0.5	<= 4.0
Ethyl Benzene	100-41-4	202-849-4	0.2	<= 4.0
Cyclohexane	110-82-7	203-806-2	1.0	<= 3.0
Naphthalene	91-20-3	202-049-5	0.1	<= 2.0
Methylcyclopentane	96-37-7	202-503-2	1.0	<= 2.0
Indene	95-13-6	202-393-6	0.5	<= 1.5

Typical composition

4. FIRST AID MEASURES

General advice

Causes skin irritation. May cause minor eye irritation. Aspiration into the lungs during swallowing or vomiting can cause lung damage, possibly leading to chronic lung dysfunction or death. Inhalation of vapors may cause signs of respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death), possible cardiac sensitization, and irritation of the eyes, nose and throat. Harmful: danger of serious damage to health by prolonged exposure through inhalation. May cause cancer. This substance may be genotoxic. Always observe self-protection methods. Move out of dangerous area. Do not leave the victim unattended. Remove contaminated shoes and clothing. Get medical attention immediately. Show this material safety data sheet to the doctor in attendance.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. Never use low boiling point naphthas for washing contaminated skin. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

Notes to physician

Treat symptomatically. Inhalation may cause CNS depression. Overexposure may produce anesthetic or narcotic effects. Do not induce vomiting. Risk of damage to lungs exceeds poisoning risk. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard.

5. FIRE-FIGHTING MEASURES



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Flammable properties

Classification

Extremely flammable liquid.

Flash point

< -40 °C (< -40 °F) Tag closed cup

Autoignition temperature

> 250 °C (> 482 °F)

Lower explosion limit

1.4 vol% (% vol in air).

Upper explosion limit

7.6 vol% (% vol in air).

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Dry chemical. CO₂. Water spray. Foam. Sand. LARGE FIRES: Water spray. Water fog. Foam. Dry chemical. CO₂. Sand.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

When exposed to ignition source in air, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. Releases flammable vapors below normal ambient temperatures. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Prevent fire extinguishing water from contaminating surface water or the ground water system. When fighting a fire, notify environmental authorities if liquid enters sewers or public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon monoxide and other toxic vapors.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Extinguish all ignition sources. Stop leak if you can do it without risk. Evacuate/limit access. Restrict water use for cleanup. Notify fire and environmental authorities. Note: recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken. A vapor suppressing foam may be used to reduce vapors. DO NOT use water jet. Use clean non-sparking tools to collect absorbed material. On water, material is insoluble and floats. On water, contain/minimize dispersion/collect. Remove from surface water (e.g. by skimming or siphoning). The use of dispersants should be advised by an expert, and, if required, approved by local authorities.

Liquids/vapors may ignite. Contain/collect rapidly to minimize dispersion. Prevent spreading of vapors through sewers, ventilation systems and confined areas. Do not touch or walk through spilled material. Water spray may reduce vapor; but



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Spills and leaks

may not prevent ignition in closed spaces. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.

7. HANDLING AND STORAGE

Handling

Electrostatic charge may build up during handling. Equipment should be grounded and bonded. During transfer of product, ground container and insure that all conveying equipment is properly grounded. Always keep nozzle in contact with the container throughout the loading process. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Electrostatic charges may be generated as a result of flow or agitation. Use only non-sparking tools. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. Keep container closed and drum bungs in place. Store away from heat, sparks, open flames, strong oxidizing agents and direct sunlight. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of U.S. national electrical code, U.S. National Fire Protection Agency (NFPA). Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Never siphon by mouth. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Ensure adequate ventilation, especially in confined areas. Eliminate all sources of ignition. Spilled material can make walking hazardous, potentially causing falls and serious injury. Do not breathe vapor. Avoid contact with skin. Do not smoke. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Use good housekeeping practices during use, storage, transfer, and handling.

Storage

Store only in tightly closed, properly vented containers away from heat, sparks, open flame and strong oxidizing agents. Store closed drums with bung in up position. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Electrical installations / working materials must comply with the technological safety standards. Keep container tightly closed and properly labeled. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Storage area layout, tank design, equipment and operating procedures must comply with the relevant European, national or local legislation. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Store and transport in accordance with all applicable laws.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. Use adequate ventilation to keep vapor concentrations below applicable exposure limit(s).

Personal protective equipment

Inhalation

Appropriate respiratory protection where atmosphere exceeds recommended limits. If exposure may exceed the exposure limit(s), use respiratory equipment recommended or approved by appropriate local, state or international agency.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Gasoline	US (ACGIH)	STEL	500 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Benzene	US (ACGIH)	STEL	500 ppm	None.
	US (ACGIH)	TWA	300 ppm	None.
	US (ACGIH)	TWA	300 ppm	None.
	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
Xylene	NIOSH	IDLH	500 ppm	None.
	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
Ethyl alcohol	US (ACGIH)	STEL	1,000 ppm	None.
	US (OSHA)	TWA	1,000 ppm 1,900 mg/m ³	None.
	NIOSH	IDLH	3,300 ppm	None.
Toluene	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.
n-Hexane	US (ACGIH)	TWA	50 ppm	None.
	US (OSHA)	TWA	500 ppm 1,800 mg/m ³	None.
	NIOSH	IDLH	1,100 ppm	None.
n-Pentane	US (ACGIH)	TWA	600 ppm	None.
	US (OSHA)	TWA	1,000 ppm 2,950 mg/m ³	None.
	NIOSH	IDLH	1,500 ppm	None.
Naphthalene	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

	US (OSHA)	TWA	10 ppm 50 mg/m ³	None.
	NIOSH	IDLH	250 ppm	None.
Trimethyl benzene	US (OSHA)	TWA	25 ppm	None.
	US (ACGIH)	TWA	25 ppm	None.
Cyclohexane	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	300 ppm 1,050 mg/m ³	None.
	NIOSH	IDLH	1,300 ppm	None.
Cumene	US (ACGIH)	TWA	50 ppm	None.
	US (OSHA)	TWA	50 ppm 245 mg/m ³	None.
	NIOSH	IDLH	900 ppm	None.
Indene	US (ACGIH)	TWA	5 ppm	None.
Methyl Cyclohexane	US (ACGIH)	TWA	400 ppm	None.
	US (OSHA)	TWA	500 ppm 2,000 mg/m ³	None.
	NIOSH	IDLH	1,200 ppm	None.
Ethyl Benzene	US (ACGIH)	STEL	125 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
	NIOSH	IDLH	800 ppm	None.
t-Butyl Methyl Ether	US (ACGIH)	TWA	50 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid colorless, to, light yellow

Odor: Gasoline or naphtha odor.

Odor Threshold: No value available.

pH: not applicable

Boiling point/boiling range: 25 - 221 °C (77 - 429.8 °F)

Melting/freezing point: No Data Available.

Flash point: < -40 °C (< -40 °F) Tag closed cup

Autoignition temperature: > 250 °C (> 482 °F)

Flammability: Extremely flammable liquid.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Lower explosion limit: 1.4 vol% (% vol in air).

Upper explosion limit: 7.6 vol% (% vol in air).

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: 4 - 240 kPa @ 37.8 °C (100.04 °F) 4 - 240 kPa @ 37.8 °C (100.04 °F)

Evaporation rate: No Data Available.

Relative density: 0.62 - 0.88 @ 15 °C (59 °F)

Relative vapor density: not determined

Viscosity: < 1 mm²/s @ 37.8 °C (100.04 °F)

Water solubility: 0.03 - 0.1 g/l

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

This product is normally stable.

Conditions to avoid

Heat, sparks, open flames and strong oxidizing conditions.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Incomplete combustion can result in the production of carbon monoxide, carbon dioxide and other toxic gases.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Inhalation of high vapor concentrations can cause CNS-depression and narcosis. Inhalation of vapors in high concentration may cause shortness of breath (lung edema). Solvents may degrease the skin. This product contains benzene. Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact. Benzene can destroy blood-forming cells in the bone marrow and is associated with leukemia and possibly other cancers. This material also contains components that may cause hearing loss and may be a developmental toxin. Toluene has known developmental toxicity. Suspect reproductive hazard - contains material which may injure unborn child. Suspect reproductive hazard. Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Product Summary

Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. This product may contain ETBE. Kidney effects specific to male rats (hyaline droplet nephropathy) and liver enlargement with no evidence of structural damage in mice were reported following repeated exposure to ETBE vapor.

Acute toxicity

LC50 (Inhl) rat >5.61 4 HOURS

LD50 (Skin) rabbit >2000 MG/KG

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Inhalation may cause CNS depression. Can cause pulmonary edema if aspirated into lungs.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Skin

Irritating to skin.

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Skin. Central nervous system. Blood. central nervous system (CNS) Liver. Kidneys.

Repeated dose toxicity

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Genetic Toxicity

Mutagenic Substance. May cause genetic defects. Stream expected to be mutagenic based on toxicity information for components present in this stream.

Carcinogenicity

May cause cancer. Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream.

Other information

This product contains benzene. Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact. Contains xylene(all isomers). May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard. Ethyl alcohol May cause eye and upper respiratory tract irritation. Short-term overexposure above 1,000 ppm by the inhalation route may cause central nervous system (CNS) effects such as headache and irritation of eyes, nose and throat. If continued for more than an hour additional CNS effects may occur such as: dizziness, drowsiness, loss of a ppetite, and an



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Other information

inability to concentrate. Gastrointestinal (stomach) effects may occur with symptoms such as nausea and vomiting. Long-term exposure can also cause loss of appetite, weight loss, nervousness, memory loss, mental retardation and liver damage. May cause dermatitis by defatting the skin from prolonged or repeated contact. Alcoholic beverages are carcinogenic to humans. Ethanol is a developmental toxin and various effects have been associated with ethanol intake. Examples of chronic ethanol abuse effects include physical dependence, malnutrition, amnesia, dementia, somnolence, cardiac myopathy, hepatotoxicity, GI bleeding and pancreatitis. Combined exposure to ethanol and certain other chemicals may result in increased toxic effects. Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye. Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity. n-hexane May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Suspect reproductive hazard. naphthalene. Maybe irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus. cumene Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. May cause kidney and/or lung damage. May cause cancer. Ethyl benzene May effect hearing. Repeated or prolonged exposure may cause severe irritation of the nose, throat and lungs, as well as liver and kidney damage. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Toxic to aquatic life with long lasting effects.

Acute Fish toxicity

LL50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 10 mg/l

LL50 / 96 HOURS Pimephales promelas (fathead minnow) 8.2 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS Daphnia magna (Water flea) 4.5 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS Pseudokirchneriella subcapitata (green algae) 3.1 mg/l

NOELR / 72 HOURS Pseudokirchneriella subcapitata (green algae) 0.5 mg/l

Toxicity to microorganisms

EC50 / 40 HOURS Tetrahymena pyriformis (ciliated protozoa) 15.41 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOELR / 14 d fish. 2.6 mg/l

Summary: QSAR (Quantitative structure-activity relationship) based calculation predicts low chronic toxicity.

Chronic toxicity to aquatic invertebrates

NOELR / 21 d Daphnia magna (Water flea) 2.6 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Partitioning mainly to air. Environmental releases partition mainly to water.
 Predicted distribution to environmental compartments: The product is insoluble and floats on water.

Persistence and degradability

Stability in water: The product is insoluble and floats on water.

Biodegradation: Not expected to be hydrolytically unstable. Not readily, but considered likely to be inherently biodegradable.

Bioaccumulation: This material may bioaccumulate.

13. DISPOSAL CONSIDERATIONS

Contaminated product, soil, water, and empty containers may be hazardous wastes due to possible presence of flammable gases. Assure emissions comply with applicable regulations. Preferred disposal for this volatile, flammable product is through combustion. Proper grounding procedures to avoid static electricity should be followed. The product should not be allowed to enter drains, water courses or the soil.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Gasoline

Reportable quantity Benzene

ID No. UN1203

Hazard class 3

Packing group II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Canada	DSL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

TSCA 12b

Pentane (CAS RN 109-66-0) Naphthalene / CAS# 91-20-3

SARA 302/304

This product contains no known chemicals regulated under SARA 302/304.

SARA 311/312



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

GASOLINE

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

This product contains no known chemicals regulated under SARA 313.

State Reporting

This product contains no known chemicals regulated by California's Proposition 65.

This product contains no known chemicals regulated by New Jersey's Worker and Community Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

This product contains no known chemicals regulated by Pennsylvania's Right to Know Act.

Labeling

Other

No additional information available.

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Revised Section(s): 1 2 4 5 6 7 8 9 10 11 April 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations



MATERIAL SAFETY DATA SHEET

MSDS No.: BE173
Variant: U.S.A.-EN
Revision: 1.2
Validation Date: 05/20/2011

GASOLINE

This document may be available in languages other than English.

End of Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

 MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

 APO012
 HFR# 2.2.0

1. PRODUCT AND COMPANY IDENTIFICATION
Product name: ULTRA LOW SULFUR DIESEL

Number: 00000000000016111

Chemical characterization: Diesel Fuels

CAS-No.: 68334-30-5

Chemical Name: Diesel Fuel, Ultra Low Sulfur Diesel, ULSD

Synonyms: Grade 2 Distillate Fuel, Diesel Fuel Oil, Heating Oil, Furnace Oil, Motor Fuels, ULSD 15 ppm TX Led

Company Address

 Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

 Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

 CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION
Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

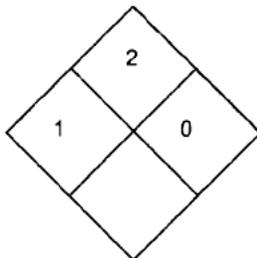
Signal Word

WARNING.

Hazards

Combustible liquid. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. May cause central nervous system effects. Causes headache, drowsiness or other effects to the central nervous system. Can cause mild eye and skin irritation. MAY BE HARMFUL IF SWALLOWED. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death. Marine diesel fuel is possibly carcinogenic to humans (Group 2B) Listed by IARC as a group 2B - Possible Human Carcinogen. Distillate (light) fuels are not classifiable as to their carcinogenicity to humans (Group 3).

NFPA®



HMIS®

Health	*	2
Flammability		2
Physical Hazard		0

Physical state

liquid

Color



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

Color

Clear, colorless to light amber.

Odor

characteristic

Odor Threshold

No Data Available.

Potential health effects

Routes of exposure

Skin. Inhalation. Ingestion.

Acute effects

Skin

May produce skin irritation. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Inhalation

Can cause pulmonary edema if aspirated into lungs.

Eyes

May cause moderate irritation, including burning sensation, tearing, redness or swelling. Effects of eye irritation are reversible.

Ingestion

Aspiration may cause lung damage.

Chronic effects

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. Prolonged or repeated exposure to vapors may cause lung damage.

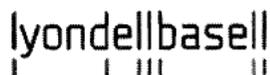
Aggravated Medical Condition

Persons with pre-existing chronic respiratory disease or skin disorders should minimize their exposure to this material.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
1,1'-Biphenyl	92-52-4	202-163-5	0.5 <= 1.5
Naphthalene	91-20-3	202-049-5	0.0 <= 3.0
Diesel Fuel Oil	68334-30-5	269-822-7	0.0 <= 100.0
Trimethyl benzene	25551-13-7	247-099-9	0.5 <= 1.5

Typical composition



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Remove contaminated clothing and wash skin with plenty of soap and water. Wash clothing before wearing again.

Inhalation

Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

Check for and remove contact lenses. Immediately flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower lids. If pain or irritation persists, promptly obtain medical attention.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately.

Notes to physician

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IIIA Combustible Liquid.

Flash point

>= 60 °C (>= 140 °F)

Autoignition temperature

> 200 °C (> 392 °F)

Lower explosion limit

~ 0.6 vol%

Upper explosion limit

~ 7.5 vol%

Extinguishing Media

Suitable extinguishing media

LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. SMALL FIRE: Carbon Dioxide. Sand. Foam. Dry powder

Unsuitable extinguishing media

Do not use solid water stream/may spread fire.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

Precautions for fire-fighting

Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Assure good ventilation to prevent flammable vapor formation. This material releases flammable vapors at well below ambient temperatures and may form flammable mixtures with air. When mixed with air in certain proportions and exposed to an ignition source, these vapors can burn in the open or be explosive in confined spaces. Being heavier than air, these vapors may travel long distances along the ground before reaching a point of ignition and flashing back. Burning liquid may float on water. Notify authorities immediately if liquid enters sewer/public waters.

Hazardous combustion products

Carbon dioxide, carbon monoxide, smoke, fumes and unburned hydrocarbons.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Combustible liquid. Release causes immediate fire/explosion hazard. Evacuate/limit access. Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do so without risk. Prevent entry into waterways, sewers, basements, or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, nonsparking tools to collect absorbed material. For large spills, secure the area and control access. Dike far ahead of liquid spill to ensure complete collection. Water spray may be used to reduce vapor, but it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. In an urban area, clean up spill as soon as possible; in natural environments, clean up on advice from an ecologist. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible materials. Place into appropriate waste containers for later disposal. The spilled material and any soil or water which it has contacted will be hazardous to animals and/or aquatic life. Comply with all laws and regulations.

7. HANDLING AND STORAGE

Handling

Electrostatic charge may build up during handling. Equipment should be grounded and bonded. During transfer of product, ground container and insure that all conveying equipment is properly grounded. Always keep nozzle in contact with the container throughout the loading process. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Electrostatic charges may be generated as a result of flow or agitation. Use only non-sparking tools. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. Keep container closed and drum bungs in place. Store away from heat, sparks, open flames, strong oxidizing agents and direct sunlight. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of U.S. national electrical code, U.S. National Fire Protection Agency (NFPA). Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Never siphon by mouth. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Wash thoroughly after handling with soap and water.

Storage

Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room. Keep containers tightly closed when not in use and store in a well-ventilated area. Isolate incompatible materials such as oxidizers. Containers should be clearly labeled. Metal containers used to store this material should be grounded. Do not store near strong oxidizers. Electrical installations / working materials must comply with the technological safety standards. Vapors may form explosive mixtures with air. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

Storage

Static electricity accumulation may be significantly increased by the presence of small quantities of water. Store and transport in accordance with all applicable laws.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use adequate ventilation to keep vapor concentrations below applicable exposure limit(s). Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If mechanical ventilation is used, electrical systems should conform to U.S. National Electric Code. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

A respiratory protection program which complies with U.S. Occupational Safety and Health Administration (OSHA) general industry standard 1910.134(e) should be implemented. Where exposure through inhalation may occur from use, approved respiratory protection equipment is recommended. Where excessive vapor, mist, or dust may result from use, use approved respiratory protection equipment. NIOSH approved organic vapor respirator equipped with a dust/mist prefilter should be used. For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA).

Skin

Avoid contact with skin. Skin should be washed after contact. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners. Recommended preventive skin protection Avoid contact with skin. Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.

Eyes

Safety glasses are the minimum requirements. Use splash goggles when eye contact due to splashing or spraying liquid is possible.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Odor is an inadequate warning for hazardous conditions. Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
1,1'-Biphenyl	US (ACGIH)	TWA	0.2 ppm	None.
	US (OSHA)	TWA	0.2 ppm 1 mg/m ³	None.
Naphthalene	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	US (OSHA)	TWA	10 ppm 50 mg/m ³	None.
Diesel Fuel Oil	ACGIH	TWA	100 mg/m ³	None.
	US (ACGIH)	TWA	100 mg/m ³ inhalable fraction and vapor, as Total hydrocarbon	None.
Trimethyl benzene	US (OSHA)	TWA	25 ppm	None.
	US (ACGIH)	TWA	25 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Clear, colorless to light amber.

Odor: characteristic

Odor Threshold: No Data Available.

pH: Not applicable.

Boiling point/boiling range: 160 - 400 °C (320 - 752 °F)

Melting/freezing point: No Data Available.

Flash point: ≥ 60 °C (≥ 140 °F)

Autoignition temperature: > 200 °C (> 392 °F)

Flammability: OSHA/NFPA Class IIIA Combustible Liquid.

Lower explosion limit: ~ 0.6 vol%

Upper explosion limit: ~ 7.5 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: 0.4 kPa @ 40 °C (104 °F) (Estimated)

Evaporation rate: No Data Available.

Relative density: 0.81 - 0.90 @ 15 °C (59 °F)

Relative vapor density: not determined

Viscosity: 2.0 - 7.4 mm²/s @ 40 °C (104 °F)

Water solubility: < 1 mg/l

Solubility (l): No Data Available.

Partition coefficient: n-octanol/water: no data available

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks and open flame.

Materials to avoid



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

Materials to avoid

Strong acids, bases, and oxidizing agents, such as liquid chlorine and oxygen. May react with peroxides.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

May produce skin irritation. Slight eye irritant. Inhalation of vapors may cause respiratory distress and CNS effects. Aspiration may cause lung damage. Marine diesel fuel is possibly carcinogenic to humans (Group 2B) Distillate (light) fuels are not classifiable as to their carcinogenicity to humans (Group 3).

Acute toxicity

<u>LC50 (Inhl)</u>	rat	4.6 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	>5000 MG/KG	
<u>LD50 (Skin)</u>	rabbit	>2000 MG/KG	

Acute effects

Inhalation

Inhalation may cause CNS depression. Respiration of solvent vapor may cause dizziness. Can cause pulmonary edema if aspirated into lungs.

Ingestion

Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Skin irritant. Repeated exposure may cause cracking and drying due to the extraction of oils.

Irritation

Skin

Irritating to skin.

Eyes

slight irritation

Sensitization

Not expected to be a sensitizer.

Target Organs

Skin. Central nervous system. Lungs

Repeated dose toxicity

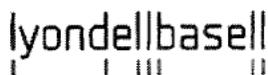
Prolonged contact with the skin may cause mechanical irritation and subsequent dermatitis.

Genetic Toxicity

This substance is a low concern for genetic toxicity. Mutagenicity in vivo studies have shown negative results in animals. Mutagenicity in vitro studies have shown predominantly negative results in animals.

Carcinogenicity

Marine diesel fuel is possibly carcinogenic to humans (Group 2B) Distillate (light) fuels are not classifiable as to their carcinogenicity to humans (Group 3).



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

Other information

Contains naphthalene. May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus. Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bwt/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bwt/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice). Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bwt orally or 250 mg/kg bwt by intraperitoneal injection. The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

Acute Fish toxicity

LC50 / 96 HOURS *Pimephales promelas* (fathead minnow) 35 mg/l (flow-through)

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Environmental releases partition mainly to water.

Predicted distribution to environmental compartments: The product is insoluble and floats on water.

Persistence and degradability

Stability in water: The product is insoluble and floats on water.

Biodegradation: Not readily biodegradable.

Bioaccumulation: This material may bioaccumulate.

13. DISPOSAL CONSIDERATIONS

It is the responsibility for the waste generator to characterize waste streams relative to the pertinent regulatory provisions to ensure that applicable requirements are reviewed and met. Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations. Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. The materials resulting from clean-up operations may be hazardous wastes and therefore, subject to specific regulations. Contact the RCRA Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulation (see 40 CFR Parts 260 through 271). State and/or local regulations may be more restrictive.

14. TRANSPORT INFORMATION



MATERIAL SAFETY DATA SHEET

MSDS No.: BE164
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

Proper shipping name Diesel fuel
Reportable quantity BIPHENYL
 NAPHTHALENE
ID No. NA1993
Hazard class 3
Packing group III

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

TSCA 12b

Naphthalene / CAS# 91-20-3 Biphenyl / CAS# 92-52-4

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
1,1'-Biphenyl		100 lbs
Naphthalene		100 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Fire Hazard.
 Delayed (Chronic) Health Hazard.
 Immediate (Acute) Health Hazard.

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

<u>Component</u>	<u>Reporting Threshold</u>
1,1'-Biphenyl	1.0%
Naphthalene	0.1%

State Reporting

Known to the State of California to cause cancer.

91-20-3 Naphthalene

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

92-52-4 1,1'-Biphenyl
 91-20-3 Naphthalene
 25551-13-7 Trimethyl benzene

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE164
Variant: U.S.A.-EN
Revision: 1.1
Validation Date: 08/27/2010

ULTRA LOW SULFUR DIESEL

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

92-52-4 1,1'-Biphenyl
91-20-3 Naphthalene
25551-13-7 Trimethyl benzene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

92-52-4 1,1'-Biphenyl
91-20-3 Naphthalene
68334-30-5 Diesel Fuel Oil
25551-13-7 Trimethyl benzene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:
Conversion to SAP template. July 2010

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

AP0104
 HFR#2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: ALKYLATE

Number: 00000000000016076

Internal ID: AP0104

Chemical characterization: C4-C12 Alkane Hydrocarbons

CAS-No.: 68527-27-5

Synonyms: Alkylate Naphtha; Alkylate Gasoline; Gasoline Blend Stock, Full-range Naphtha from a H2SO4 Alkylation Unit

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

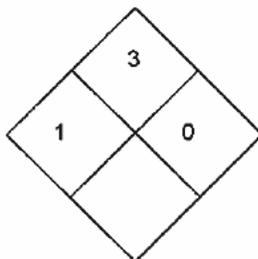
Signal Word

DANGER.

Hazards

Extremely flammable. Vapor may cause flash fire or explosion. May be harmful if inhaled, swallowed or absorbed through the skin. May be irritating to the eyes, skin, and respiratory system. Overexposures may cause central nervous system (CNS) depression and/or other target organ effects.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state

liquid

Color

Clear, colorless.

Odor

Gasoline/hydrocarbon like odor.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

Odor Threshold
 No Data Available.

Potential health effects

Routes of exposure
 Eye. Inhalation. Skin. Ingestion.

Acute effects

High concentrations of vapor reduce oxygen available for breathing. May cause eye, skin, and/or respiratory tract irritation and inflammation. May be harmful or fatal if inhaled, ingested, or absorbed through the skin. See component summary.

- *Octane Isomers*

May be irritating to the skin. Aspiration hazard. CNS depressant.

- *Heptane (and isomers)*

CNS depressant. Aspiration hazard.

- *Hexane Isomers*

May be irritating to the eyes, skin, and respiratory system. Inhalation of vapors may cause dizziness, narcosis, nausea or asphyxiation. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Isopentane 78-78-4*

This product may cause eye, skin, and respiratory tract irritation. High concentrations may cause central nervous system (CNS) depression. Ingestion would likely cause gastrointestinal tract irritation.

- *n-Butane 106-97-8*

Simple asphyxiant. Inhalation of vapors may cause dizziness, narcosis, nausea or asphyxiation. CNS depressant.

Skin

Irritating to the skin, not a sensitizer. May be absorbed through the skin and produce toxic effects such as CNS depression.

Inhalation

Breathing high concentrations of vapor or mist may cause respiratory tract irritation, nausea, vomiting, central nervous system (CNS) depression and asphyxiation. Symptoms may include headache, dizziness, blurred vision, slurred speech, memory loss, confusion, fatigue, loss of consciousness, convulsions, paralysis, or coma.

Eyes

Based upon animal test data on a similar product, no irritation to only minimal eye irritation is expected upon short-term exposure.

Ingestion

Irritates mucous membranes of the mouth, throat, and esophagus and is readily absorbed by the stomach and intestinal tract. CNS symptoms include nausea, vomiting, pallor, dizziness, staggering gait, drowsiness, shallow rapid pulse, loss of consciousness, and delirium prior to the onset of convulsions, coma, and death. Ingestion and/or vomiting of this material may result in aspiration into the lungs. Even a small amount of this liquid entering the lungs can produce potentially fatal effects (pulmonary edema and pneumonitis).

Chronic effects

Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung tumor) formation and chronic lung dysfunction. Altered mental states, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "petrol sniffers encephalopathy"), delirium, seizures, and sudden death have been common symptoms among gasoline and naphtha abusers.

- *Octane Isomers*

Lungs may be affected by repeated or prolonged exposure.

- *Heptane (and isomers)*

Repeated or prolonged exposure to styrene may cause nausea, loss of Appetite, CNS depression, and general weakness.

- *Hexane isomers*

Eye irritation, skin irritation leading to dermatitis, chemical pneumonia, and central nervous system depression may occur



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

from repeated or prolonged exposure.

- *Isopentane 78-78-4*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. This substance is a developmental toxicant.

- *n-Butane 106-97-8*

Repeated or prolonged exposure to low levels of this material produces no known adverse chronic health hazards.

Aggravated Medical Condition

Persons with pre-existing skin disorders, peripheral or central nervous system (CNS) disease, psychological conditions, cardiac conditions, impaired pulmonary, cardiovascular, or liver/kidney function, or chronic respiratory diseases should avoid exposure

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Octane Isomers	Mixture	Isomeric Mixture	58.0 <= 65.0
Heptane (and isomers)	Mixture	Isomeric mixture	7.0 <= 8.0
Hexane isomers	Mixture	Mixture	5.0 <= 7.0
Isopentane	78-78-4	201-142-8	5.0 <= 7.0
n-Butane	106-97-8	203-448-7	0.5 <= 2.0

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Immediately remove excess chemical and contaminated clothing; thoroughly wash contaminated skin with mild soap and water. If irritation persists after washing, seek medical attention. Thoroughly clean contaminated clothing before reuse; discard contaminated leather goods (gloves, shoes, belts, wallets, etc.).

Inhalation

Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

Immediately flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower lids. If pain or irritation persists, promptly obtain medical attention.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

Ingestion
 attention immediately.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

-43 - -23 °C (-45.4 - -9.4 °F) Tag closed cup (Estimated) ASTM D 56

Autoignition temperature

280 °C (536 °F)

Lower explosion limit

0.9 vol%

Upper explosion limit

7.6 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemicals, CO₂, or foam. LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams

Unsuitable extinguishing media

DO NOT use water jet.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear.

Precautions for fire-fighting

This material releases flammable vapors at well below ambient temperatures and may form flammable mixtures with air. When mixed with air in certain proportions and exposed to an ignition source, these vapors can burn in the open or be explosive in confined spaces. Being heavier than air, these vapors may travel long distances along the ground before reaching a point of ignition and flashing back. Evacuate area and fight from a maximum distance or use unmanned hose holders or monitor nozzles. Heat may generate flammable or explosive vapors; disperse with water spray or cover pooling liquid with foam. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Be aware that burning liquid will float on water. Notify authorities immediately if liquid enters sewer/public waters.

Hazardous combustion products

Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do so without risk. Prevent entry into waterways, sewers, basements, or confined areas. A vapor-suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, nonsparking tools to collect absorbed



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

Spills and leaks

material. For large spills, secure the area and control access. Dike far ahead of liquid spill to ensure complete collection. Water spray may be used to reduce vapor, but it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. In an urban area, cleanup spill as soon as possible; in natural environments, clean up on advice from an ecologist. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible materials. Place into appropriate waste containers for later disposal. The spilled material and any soil or water which it has contacted will be hazardous to animals and/or aquatic life. Comply with all laws and regulations.

7. HANDLING AND STORAGE

Handling

Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials. All sampling should be conducted in a manner which avoids skin contact and inhalation of vapors. Clean up any spilled material. Parts and equipment using or containing this material should be steam-cleaned if possible prior to all maintenance procedures. Empty containers retain some liquid and vapor residue and can be dangerous, so all hazard precautions must be observed when handling empties. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose containers to heat, flame, sparks, static electricity, or other sources of ignition. Empty drums should be completely drained, properly bunged and promptly disposed of or reconditioned.

Storage

Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

If good general ventilation is insufficient to keep airborne levels below recommended exposure limits, use process enclosures, local exhaust ventilation, or other engineering means to control the concentration of regulated substances.

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Skin

Wear insulated gloves if contact with liquid is possible. Use chemical resistant gloves appropriate to conditions of use. Use PPE that is chemical resistant to the product and prevents skin contact.

Eyes

Wear safety glasses as minimum eye protection. Conditions may warrant the use of chemical goggles and possibly a face shield. Consult your standard operating procedure or safety professional for advice. Use protective eye and face devices that comply with ANSI Z87.1-1987.

Occupational Exposure Limits

Consult local authorities for acceptable exposure limits.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Clear, colorless.

Odor: Gasoline/ hydrocarbon like odor.

Odor Threshold: No Data Available.

pH: Not applicable.

Boiling point/boiling range: ~ 31 - 50 °C (87.8 - 122 °F)

Melting/freezing point: -59 °C (-74.2 °F)

Flash point: -43 - -23 °C (-45.4 - -9.4 °F) Tag closed cup (Estimated) ASTM D 56

Autoignition temperature: 280 °C (536 °F)

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: 0.9 vol%

Upper explosion limit: 7.6 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: Vapor pressure 4.1 to 5.1 psia (@100 deg F)

Evaporation rate: No Data Available.

Relative density: 0.69 - 0.71 (Water = 1)

Relative vapor density: 3.0 @ 21.1 °C (69.98 °F)

Viscosity: Not applicable.

Water solubility: Slightly soluble

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

All sources of ignition.

Materials to avoid

Strong acids, alkalis, and oxidizers such as liquid chlorine and oxygen. If uninhibited, naphtha will cause rusting of copper



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

Materials to avoid

and alloys containing copper.

Hazardous decomposition products

No degradation data available.

Hazardous polymerization

Will not occur.

Reactions with Air and Water

Does not react with air, water or other common materials.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

See componentsummary. See componentsummary.

Acute toxicity

LC50 (Inhl) rat > 5.04 MG/L 4 HOURS

LD50 (Oral) rat > 7000 MG/KG

LD50 (Skin) rabbit > 2000 MG/KG

COMPONENT INFORMATION

- *Octane Isomers*

Acute effects

Ingestion

Harmful if swallowed.

Irritation

Skin

May be irritating to the skin.

- *Heptane (and isomers)*

Target Organs

Central nervous system. Lung.

Repeated dose toxicity

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Hexane isomers*

Acute effects

Inhalation

ALKYLATE

Overexposure may cause irritation to the respiratory tract and to other mucous membranes. May produce symptoms of central nervous system depression including headache, dizziness, nausea, loss of sense of balance, drowsiness, visual disturbances, unconsciousness and sense of balance, drowsiness, visual disturbances, unconsciousness and death.

Irritation

Skin

Maybe irritating to the skin.

Eyes

May cause eye irritation.

Target Organs

Skin. Eye. Respiratory system. CNS depressant.

Repeated dose toxicity

No known chronic health effects.

Reproductive effects

Not expected to occur.

Developmental Toxicity

Not expected to occur.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Isopentane* 78-78-4

Acute toxicity

<u>LC50 (Inhl)</u>	mouse	413 MG/L	2 HOURS
	rat	1281.9 MG/L	4 HOURS

Irritation

Skin

Defatting of the skin with irritation, dryness and cracking.

Eyes

Slight eye irritant.

Target Organs

Skin. Eye.

Repeated dose toxicity

Repeated oral gavage exposures of rats to 500 mg/kg bwt/day isopentane produced lethality and decreases in bodyweight gain.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Butane* 106-97-8

Acute toxicity

<u>LC50 (Inhl)</u>	rat	658 MG/L	4 HOURS
	mouse	680 MG/L	2 HOURS

Acute effects

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Irritation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

Skin

None expected. Evaporating liquid may cause frost bite.

Eyes

None expected. Evaporating liquid may cause frost bite.

Target Organs

CNS depressant.

Repeated dose toxicity

No biologically significant treatment-related systemic effects were seen when rats were exposed by inhalation for 4-6 weeks to 9000 ppm (21.4 mg/L) n-butane.

Reproductive effects

No signs of reproductive toxicity were observed in an inhalation screening test of rats exposed to up to 9000 ppm (21.39 mg/L) n-butane.

Developmental Toxicity

No signs of developmental toxicity were observed in an inhalation screening test of rats exposed to up to 9000 ppm (21.39 mg/L) n-butane.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Volatile hydrocarbon compounds in this product may be released to the atmosphere and react with photochemically-produced hydroxyl radicals to create smog. If spilled, this product, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This material is potentially toxic to freshwater and saltwater ecosystems. It will normally float on the water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways a naphtha layer can cover a large surface area and limit or eliminate the natural atmospheric oxygen transport into the water. Over time, this could be harmful or fatal. The coating action of this material may also be harmful or fatal to water birds and aquatic life.

Environmental fate and pathways

No information found in our selected references.

Persistence and degradability

Bioaccumulation: Not expected to occur.

COMPONENT INFORMATION

- *Octane Isomers*

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

- *Heptane (and isomers)*

Ecotoxicity

No Data Available.

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. This material is not expected to persist in the environment.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: This material is expected to have slight mobility in soil.

Bioaccumulation: This material may bioaccumulate.

- *Hexane isomers*

Ecotoxicity

No Data Available.

Environmental fate and pathways

Persistence and degradability

Bioaccumulation: Not expected to occur.

- *Isopentane 78-78-4*

Ecotoxicity

This material is toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna*. 2.3 mg/l

Environmental fate and pathways

This material is likely to evaporate from soil and water.

Persistence and degradability

Stability in water: Volatilization from water surfaces is expected to be an important environmental fate process.

Stability in soil: Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

- *n-Butane 106-97-8*

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

This material is expected to be non-hazardous to aquatic species.

Environmental fate and pathways

This material is likely to evaporate from soil and water.

Persistence and degradability

Stability in water: Not likely to adsorb to suspended solids and sediment in water.

Stability in soil: Expected to have very high to moderate mobility in soils. Volatilization from surface soil may be quite rapid, although this process may be slowed by dicyclopentadiene's adsorption to the soil. This compound is expected to display low mobility. Biodegradation and hydrolysis are not expected to be significant factors.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

Recycle if possible. This material is classified as a Hazardous Material by RCRA. Use only permitted transporters and disposal facilities and conform to all laws. If this material is introduced into a wastewater treatment system, chemical and biological oxygen demand will increase. This material will biodegrade if gradually exposed to microorganisms, preferably in an aerobic environment. In concentration of 0.2 volume percent or less, this material will have little or no effect on sewage-seeded wastewater bio-oxidation and/or digestion. A concentration of 1.0 volume per cent will double the required digestion period. Higher concentrations interfere with floc formation and settling and may also plug filters or exchange beds. Vapor emissions from a bio-oxidation process might prove to be a potential health hazard.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product. If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Petroleum distillates, n.o.s. (Octane Isomers, Heptane Isomers)

ID No. UN1268
Hazard class 3
Packing group I

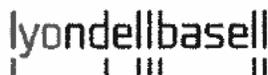
15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
European Union	EINECS
Korea	ECL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE207
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

ALKYLATE

All components of this product are listed or are exempt from listing on the TSCA 8(b) inventory. If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.

SARA 302/304

This product contains no known chemicals regulated under SARA 302/304.

SARA 311/312

Immediate Health Delayed Health Fire

SARA 313

This product contains no known chemicals regulated under SARA 313.

State Reporting

This product contains no known chemicals regulated by California's Proposition 65.

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

106-97-8 n-Butane
 78-78-4 Isopentane

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

106-97-8 n-Butane
 78-78-4 Isopentane

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

106-97-8 n-Butane
 78-78-4 Isopentane

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Last revision: 11 March 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE207
Variant: U.S.A.-EN
Revision: 1.2
Validation Date: 05/20/2011

ALKYLATE**Numerical Data Presentation**

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet

Material Safety Data Sheet

 MSDS No
AP0106

ISOBUTANE - HIGH PURITY

HMIS	IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product. This product is covered by the OSHA Hazard Communication Standard and this document has been prepared in accord with the MSDS requirements of the rule.	Protective Equipment					
<table border="1"> <tr> <td>Health Hazard</td> <td>2</td> </tr> <tr> <td>Fire Hazard</td> <td>4</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> </table> * = Chronic Health Hazard		Health Hazard	2	Fire Hazard	4	Reactivity	0
Health Hazard	2						
Fire Hazard	4						
Reactivity	0						

SECTION 1: IDENTIFICATION

 Trade Name **Isobutane - High Purity**

 MSDS No. **AP0106**

 Product Number **E001000600**

 Revision Date **11/01/06**

 CAS Number **75-28-5**

 Synonyms **2-Methylpropane; Trimethylmethane; IC4; Liquefied Petroleum Gas or LPG or LP-Gas.**

 Generic Name **Isobutane**

 Chemical Family **C3-C4 Alkane Hydrocarbons**

 Manufacturer **Company**
Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

Business Contact
Product Safety 800-700-0946

24 Hour Emergency Contact
CHEMTREC 800-424-9300
CANUTEC-Canada 613-996-6666
LYONDELL 800-245-4532

SECTION 2: COMPOSITION

Component Name	CAS Number	Carcinogenic Listings	Concentration Wt%
C3-C4 HYDROCARBONS WHICH CONTAIN	68476-40-4	Not applicable	EQ 100
ISO-BUTANE	75-28-5	Not applicable	AP 97 to 99
N-BUTANE	106-97-8	Not applicable	AP 1 to 3
PROPANE	74-98-6	Not applicable	AP 0 to 2

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

 Signal Word **DANGER!** Color **Colorless liquid/invisible vapor.**

 Physical State **Gas** Odor **Faint, unpleasant**

 Physical and Health Hazards **Extremely Flammable Compressed Gas! High concentrations of vapor reduce Oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation. Liquid or compressed gas contact may cause frostbite or freeze burns. Inhalation may sensitize the heart to sympathomimetic drugs.**

 Environmental Hazards **Ecological effects testing has not been conducted on this product. Releases are expected to cause only localized non-persistent environmental damage.**

POTENTIAL HEALTH EFFECTS

 Routes of Exposure **Inhalation; Skin and Eye Contact.**

Signs and Symptoms of Acute Exposure

- **Inhalation** High concentrations of this gas will exclude Oxygen and may lead to central nervous system (CNS) depression or asphyxiation. Symptoms include headache, dizziness, visual disturbances, intoxication, loss of coordination, drowsiness, muscular fatigue, rapid breathing, narcosis, tremors, convulsions, unconsciousness, coma, and/or death, depending upon the concentration level and duration of exposure.
- **Eye Contact** This gas is non-irritating, but, direct contact with liquefied/pressurized gas or frost particles may produce severe, and possibly permanent, eye damage from freeze burns.
- **Skin Contact** Non-irritating, but, solid and liquid forms of this material and pressurized gas can cause freeze burns.
- **Ingestion** Ingestion is not an applicable route of exposure for gases.

Chronic Health Effects Summary

Propane and n-Butane may cause a weak cardiac sensitization to Epinephrine (Adrenaline)-like drugs.

Conditions Aggravated by Exposure

Personnel with pre-existing chronic respiratory diseases, CNS disease, or cardiac conditions should avoid exposure. Persons who are compromised in their ability to use Oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of "Simple Asphyxiants".

Target Organs

Skin, eyes, central nervous system, and heart.

Carcinogenic Potential

Please refer to Section 2 for the identification of components, if any, which have been identified as having carcinogenic potential.

SECTION 4: FIRST AID MEASURES

- Inhalation** Evacuate the victim to a safe, fresh air area as soon as possible. Loosen tight clothing such as a collar, tie, belt, or waistband. If breathing is difficult, administer air or oxygen. If the victim is not breathing, administer cardiopulmonary resuscitation (CPR), as necessary. **WARNING.** Persons providing mouth-to-mouth resuscitation may be placing themselves at risk, either from exposure to toxic materials or communicable disease.
- Eye Contact** Vapors are not expected to cause an eye irritation hazard. If contacted by liquid or solid, immediately flush the eye(s) gently with warm water (105° to 115°F) for at least 15 minutes. Seek medical attention if pain or redness persists.
- Skin Contact** Frozen tissues should be flooded or soaked with warm water (105° to 115°F). **DO NOT USE HOT WATER!** Cryogenic burns which result in blistering or deeper tissue freezing should be promptly seen by a physician.
- Ingestion** Ingestion is highly unlikely. However, if ingested, and only if the patient is conscious, induce vomiting with a quart or more of warm water. Immediately obtain medical attention.
- Notes to Physician** Patient(s) should be kept quiet and warm until medical care is obtained.

This material may make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as Epinephrine (Adrenaline), and other similar sympathomimetic drugs, should be reserved for emergencies and then used only with special precaution.

SECTION 5: FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

- Flammability Classification** Extremely Flammable! OSHA/NFPA Class-IA Flammable Gas/Liquid.
- Flash Point/Method** LT -120° to -115°F by ASTM D-56.
- Flammable Limits %** LEL: AP 1.8% UEL: AP 8.4%
(Based upon NFPA "ISOBUTANE".)

Auto-Ignition Temperature	AP 550°F (288°C) by ASTM E-659 (Based upon NFPA "BUTANE".)
Hazardous Combustion Products	Burning or excessive heating may produce smoke, Carbon Monoxide, Carbon Dioxide, and possibly other harmful gases/vapors.
Special Properties	Vapor may cause flash fire or explosion! Keep away from all ignition sources! This gas releases flammable vapors at well below ambient temperatures and readily forms flammable mixtures with air. Exposed to an ignition source, it will burn in the open or explode in confined spaces. Being heavier than air, its flammable vapors may travel long distances along the ground before reaching a point of ignition, and then flash back.

EXTINGUISHING MEDIA

SHUT OFF GAS FLOW! If source cannot be shut off, withdraw from area and let the fire burn. Water fog and spray can be used to cool containers and structures adjacent to the fire. Once the gas supply is eliminated, dry chemical, Carbon Dioxide (CO₂), and/or inert gas (Nitrogen, Halon, etc.) may be used to extinguish adjacent burning materials.

FIRE FIGHTING INSTRUCTIONS

Gas fires should not be extinguished until the gas flow can be stopped. Shut off the gas source and allow the fire to burn itself out. If the source cannot be shut off immediately, all equipment and surfaces exposed to the fire should be cooled with water to prevent overheating, flash-backs, or explosions. Control the fire until the gas supply can be shut off.

Do not enter any enclosed or confined fire space without proper protective clothing and equipment. This may include a self-contained breathing apparatus to protect against the hazardous effects of combustion products and/or Oxygen deficiencies. If firefighters cannot work upwind to the fire, respiratory protective equipment must be worn. Cool tanks and containers exposed to fire with water. Withdraw immediately in case of rising sound from venting safety device or discoloration of the vessel, tank, or pipeline. Immediately notify the appropriate authorities if cryogenic liquid(s) enter sewers or waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Small Spills

Extremely Flammable Liquefied Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area upwind. Remove all potential ignition sources. Safety stop the source gas flow using non-sparking tools. Ventilate enclosed areas to prevent formation of flammable or Oxygen-deficient atmospheres. Closed gas systems form white-colored frost at the point of a leak. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Water spray may be used to reduce vapors. Avoid entering a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing.

Large Spills

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING and STORAGE

Handling

Use only with adequate ventilation/personal protection. Do NOT breathe vapor. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of Petroleum gases. If upon initial receipt inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Large pressure build-up can cause explosive decomposition at the cylinder head or release valve. The cylinder or other container will rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when handling gas/liquids.

Storage

Flammable gas/liquids should be stored in a separate safety storage cabinet or room. Keep away from heat and all other ignition sources! Keep containers tightly closed, plainly labeled, out of closed vehicles, and in a cool, well-ventilated place. A well ventilated, refrigerated room is preferable for materials with flash points lower than 70°F (AP 21°C). Containers should be able to withstand pressures expected from warming or cooling in storage. Do not puncture or incinerate containers. Do NOT contact with oxidizable materials. All electrical equipment in storage and/or handling areas should be installed in accordance with applicable requirements of the National Electrical Code and National Fire Protection Association standards.

Always chain cylinders securely and avoid placing them in high-traffic areas and away from falling objects. To prevent container damage, avoid dragging, rolling, sliding, or knocking cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and unneeded partially-filled containers should be returned to the supplier as soon as possible.

SECTION 8: EXPOSURE CONTROLS and PERSONAL PROTECTION

ENGINEERING CONTROLS

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. Ensure that an emergency eyewash station and safety shower are proximal to the work-station location.

PERSONAL PROTECTIVE EQUIPMENT

• Protective Equipment



• Eye Protection

Use chemical-type goggles and face shield when handling liquefied gases. Safety glasses with side shields and/or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.

• Skin Protection

- Hands

Use insulated, impervious, chemical-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.

- Body

Prevent potential skin contact with cold liquid, solid, or vapors. Use insulated, impervious, chemical-resistant clothing and equipment (apron, slicker suit, Tyvek, boots, etc.) to protect other potential skin contact areas.

• Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! For unknown vapor concentrations use a self contained breathing apparatus (SCBA). For known vapor concentrations, above the 1,000 ppm exposure guideline shown below in this Section, use a NIOSH/MSHA-approved organic vapor respirator, if adequate protection is provided. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent.

• General Comments

For explanation of the occupational exposure limits shown below, refer to the definition of "Simple Asphyxiant" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current **Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents** handbook. Releases of these gases may cause atmospheres, some Oxygen-deficient (LT 21 Vol.% in air), which can have flammable/explosive potential. DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for Oxygen deficiency and flammability.

EXPOSURE GUIDELINES

Substance	Source	Date	Type	Value	Time
PROPANE	ACGIH	1995	"Simple Asphyxiant"		
PROPANE	OSHA	1989	PEL	1000 ppm	8 Hrs
BUTANE	OSHA	1989	PEL	800 ppm	8 Hrs
BUTANE	ACGIH	1995	TLV	800 ppm	8 Hrs
L.P.G. (LIQUEFIED PETROLEUM GAS)	OSHA	1989	PEL	1000 ppm	8 Hrs
L.P.G. (LIQUEFIED PETROLEUM GAS)	ACGIH	1995	TLV	1000 ppm	8 Hrs

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas		
Color	Colorless liquid/invisible vapor		
Odor	Faint, unpleasant.		
pH	Not applicable.		
Vapor Pressure	AP 50 to 75 psia at 100°F.	Viscosity	Not applicable.
Vapor Specific Gravity	AP 2.0 when Air = 1.0 at 70°F.	Melting/Freezing Pt.	AP -255° to -215°F at 14.7 psia.
Volatile Characteristics	Complete (100 Wt.%)	Solubility in Water	Moderate (1 to 5 Wt.%)
Boiling Point/Range	AP -45° to 35°F (-43° to 1°C) at 14.7 psia (by ASTM D-2887)	Specific Gravity	AP 0.55 to 0.57 at 60°F.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 21,250 Btu/lb. or 3,350 Btu/cu. ft.		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.
Conditions to Avoid	Heat, sparks, open flames, and strong oxidizing conditons.
Incompatibility with Other Materials	Strong acids, alkalis, and oxidizers such as Oxygen (gas or liquid), Chlorine, Flourne and Flouride compounds, Bromine, and metal catalysts.
Hazardous Decomposition Products	Burning or excessive heating may produce smoke, Carbon Monoxide, Carbon Dioxide, and possibly other harmful gases/vapors.
Hazardous Polymerization	Not expected to occur.

SECTION 11: TOXICOLOGICAL INFORMATION

Exposure to 1,000 ppm of PROPANE for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS, including cardiac, pulmonary, or neurologic functions in humans.

No other specific information is available in our data base regarding the chronic toxic effects of this material for humans.

ISOBUTANE (2-METHYLPROPANE):

GAS (TCLo): Acute: 1,040 gm/M3 (Mouse) (2 hours) - Excitement.
GAS (LC50): Acute: 57,000 ppm (Rat) (15 minutes) - Tremors, convulsions,
& respiratory depression.

BUTANE (n-BUTANE):

GAS (LC50): Acute: 680 gm/M3 (Mouse) (2 hours).
GAS (LC50): Acute: 660 gm/M3 (Rat) (4 hours).

LIQUEFIED PETROLEUM GAS (LPG or LP-GAS):

GAS (TCLo): Acute: GT 10,000 ppm (Rabbit screen level) (4 hours) -
Cardiac sensitization.

SECTION 12: ECOLOGICAL INFORMATION

Ecological effects testing has not been conducted on this product. If it were spilled, no significant detrimental effects would be expected to occur.

Liquefied petroleum gases are essentially insoluble in water; and therefore, this product will not cause harm to aquatic life. It will normally evaporate rapidly if spilled. At ambient temperatures and pressures, Ethylene and Propylene will evaporate and may potentially contribute to generation of atmospheric smog

SECTION 13: DISPOSAL CONSIDERATIONS

When it becomes necessary to dispose of this gas, it is preferable to do so as a vapor. It may be used as an auxiliary fuel or disposed of by burning in a properly designed flare or incinerator. Venting of this gas to the atmosphere should be avoided.

SECTION 14: TRANSPORT INFORMATION

DOT Status A U.S. Department of Transportation regulated material.
Proper Shipping Name Isobutane or Petroleum gases, liquefied
Hazard Class 2.1
UN/NA ID UN1969 or UN1075
Reportable Quantity Not applicable.

Packing Group(s) Not applicable.

Placards



Emergency Response Guide Number 22

HAZMAT STCC Number 49 057 50

MARPOL III Status This product is NOT a "Marine Pollutant".

SECTION 15: REGULATORY INFORMATION

TSCA All components of this product are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 304 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on **Threshold Planning Quantities (TPQs)** and release reporting based on **Reportable Quantities (RQs)** in 40 CFR 355 (used for SARA 302, 304, 311 and 312). No chemical components present in this product exceed the de minimus reporting level established under this statute.

HoustonRefining

A Lyondell Company

ISOBUTANE - HIGH PURITY

MSDS No. AP0106

SARA 311/312

The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This product would be classified under the following hazard categories.

Immediate (Acute) Health Hazard; Fire Hazard; and Sudden Release of Pressure Hazard.

SARA 313

The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of annual release of "Toxic Chemicals" that appear in 40 CFR 372.65 (used for SARA 313) This information must be included in all MSDSs that are copied and distributed for this material. No chemical components present in this product are subject to the reporting requirements under this statute.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the "Reportable Quantities (RQs)" listed in 40 CFR 302.4. No chemical components present in this product are subject to the reporting requirements under this statute.

California Proposition 65

Per the California Safe Drinking Water and Toxics Enforcement Act of 1986, this product DOES NOT contain any of the ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm, which requires a warning under the statute.

Additional Regulatory Remarks

Food and Drug Administration (FDA): The PROPANE component of this product is currently on the "Generally Regarded As Safe (GRAS)" list.

SECTION 16: OTHER INFORMATION**HMIS (U.S.A.)**

Health Hazard	2
Fire Hazard	4
Reactivity	0

* = Chronic Health Hazard

National Fire Protection Association (U.S.A.)

**DISCLAIMER OF LIABILITY**

"The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied regarding its correctness.

Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself.

The conditions or methods of handling, storage, use, and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with handling, storage, use or disposal of the product.

This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable."

REVISION INFORMATION

Version Number 06
Revision Date 11/01/06
Revision History Logo and Manufacturer name change.

ABBREVIATIONS

HoustonRefining

A Lyondell Company

ISOBUTANE - HIGH PURITY

MSDS No. AP0106

EQ = Equal LT = Less Than GT = Greater Than AP = Approximately
NA = Not Applicable ND = No Data

***** END OF MSDS *****

Material Safety Data Sheet

 MSDS No
AP0126

ISOPENTANE

HMIS	IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product. This product is covered by the OSHA Hazard Communication Standard and this document has been prepared in accord with the MSDS requirements of the rule.	Protective Equipment
Health Hazard 2		
Fire Hazard 4		
Reactivity 0		
* = Chronic Health Hazard		

SECTION 1: IDENTIFICATION

Trade Name **Isopentane**
 Product Number 3797837978
 CAS Number 78-78-4

MSDS No. AP0126
 Revision Date 11/01/06

Synonyms Technical-grade Isopentane; C5 Isoparaffin, Isopentane/Pentane Mix, IC5/NC5 Mix, 2-Methylbutane; Ethyldimethylmethane, Isoamylhydride

Generic Name C5 Alkane Hydrocarbons
 Chemical Family C5 Paraffinic Hydrocarbons
 Manufacturer **Company**
 Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston, Texas 77252-2583

Business Contact
 Product Safety 800-700-0946
24 Hour Emergency Contact
 CHEMTREC 800-424-9300
 CANUTEC-Canada 613-996-6666
 LYONDELL 800-245-4532

SECTION 2: COMPOSITION

Component Name	CAS Number	Carcinogenic Listings	Concentration Wt%
ISO-PENTANE	78-78-4	Not applicable	AP 90 to 97
N-PENTANE	109-66-0	Not applicable	AP 3 to 10

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Signal Word DANGER! **Color** Colorless liquid/invisible vapor. Odor may be inadequate to warn of potential overexposure

Physical State Gas/Liquid **Odor** Faint, unpleasant

Physical and Health Hazards **Extremely Flammable Compressed Gas/Liquid! High concentrations of vapor reduce Oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation. Liquid or compressed gas contact may cause frostbite or freeze burns. Vapor, mist, or liquid contact may cause eye, skin, and mucous membrane irritation! May be harmful or fatal if swallowed! Contains Petroleum Distillates! If swallowed, DO NOT INDUCE VOMITING since aspiration into the lungs will cause pulmonary edema and chemical pneumonia. Inhalation may sensitize the heart to sympathomimetic drugs.**

Environmental Hazards Ecological effects testing has not been conducted on this product Releases are expected to cause only localized non-persistent environmental damage.

POTENTIAL HEALTH EFFECTS

Routes of Exposure Inhalation, Skin and Eye Contact

Signs and Symptoms of Acute Exposure

- **Inhalation** High concentrations of this gas will exclude Oxygen and may lead to central nervous system (CNS) depression or asphyxiation. Symptoms include headache, dizziness, visual disturbances, intoxication, loss of coordination, drowsiness, muscular fatigue, rapid breathing, narcosis, tremors, convulsions, unconsciousness, coma, and/or death, depending upon the concentration level and duration of exposure.
- **Eye Contact** The gas is non-irritating, but, direct contact with liquefied/pressurized gas or frost particles may produce severe, and possibly permanent, eye damage from freeze burns.
- **Skin Contact** Pressurized gas, liquid, and solid forms of this material can cause freeze burns or skin irritation and/or inflammation.
- **Ingestion** Ingestion is highly unlikely. However, if swallowed, liquid and solid forms of this material can cause freeze burns and/or irritation and inflammation of mucous membranes. Symptoms include a burning sensation of the mouth and esophagus, nausea, dizziness, and vomiting.

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting, which will result in pulmonary edema (fluid in the alveoli) and chemical pneumonitis. Cardiovascular effects include swallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.

Chronic Health Effects Summary

n-Pentane may cause a weak cardiac sensitization to Epinephrine (Adrenaline)-like drugs.

Conditions Aggravated by Exposure

Personnel with pre-existing chronic respiratory diseases, CNS disease, or cardiac conditions should avoid exposure. Persons who are compromised in their ability to use Oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excessive concentrations.

Target Organs

Skin, eyes, mucous membranes, lungs, central nervous system, heart, and bladder.

Carcinogenic Potential

Please refer to Section 2 for the identification of components, if any, which have been identified as having carcinogenic potential in animals and/or humans.

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS.

- Inhalation** Evacuate the victim to a safe, fresh air area as soon as possible. Loosen tight clothing such as a collar, tie, belt, or waistband. If breathing is difficult, administer air or oxygen. If the victim is not breathing, administer cardiopulmonary resuscitation (CPR), as necessary. **WARNING** Persons providing mouth-to-mouth resuscitation may be placing themselves at risk, either from exposure to toxic materials or communicable disease.
- Eye Contact** Vapors are not expected to cause an eye irritation hazard. If contacted by liquid or solid, immediately flush the eye(s) gently with warm water (105° to 115°F) for at least 15 minutes. Seek medical attention if pain or redness persists.
- Skin Contact** Frozen tissues should be flooded or soaked with warm water (105° to 115°F). **DO NOT USE HOT WATER!** Cryogenic burns which result in blistering or deeper tissue freezing should be promptly seen by a physician.
- Ingestion** Ingestion is highly unlikely. However, if ingested, and only if the patient is conscious, induce vomiting with a quart or more of warm water. Immediately obtain medical attention.

Notes to Physician

Patient(s) should be kept quiet and warm until medical care is obtained

This material may make the heart more susceptible to arrhythmias (irregular beats) Catecholamines such as Epinepherine (Adrenline), and other similar sympathomimetic drugs, should be reserved for emergencies and then used only with special precaution.

SECTION 5: FIRE FIGHTING MEASURES**FLAMMABLE PROPERTIES**

Flammability Classification	Extremely Flammable! OSHA/NFPA Class-IA Flammable Gas/Liquid
Flash Point/Method	AP -70°F (-57°C) by ASTM D-56
Flammable Limits %	LEL: AP 1.4% in air UEL: AP 7.6% in air (Based upon NFPA "ISOPENTANE")
Auto-Ignition Temperature	AP 788°F (420°C) by ASTM E-659 (Based upon NFPA "ISOPENTANE")
Hazardous Combustion Products	Burning or excessive heating may produce smoke, Carbon Monoxide, Carbon Dioxide, and possibly other harmful gases/vapors
Special Properties	Vapor may cause flash fire or explosion! Keep away from all ignition sources! This gas releases flammable vapors at well below ambient temperatures and readily forms flammable mixtures with air Exposed to an ignition source, it will burn in the open or explode in confined spaces Being heavier than air, its flammable vapors may travel long distances along the ground before reaching a point of ignition, and then flash back

EXTINGUISHING MEDIA

SHUT OFF GAS FLOW! If source cannot be shut off, withdraw from area and let the fire burn Water fog and spray can be used to cool containers and structures adjacent to the fire. Once the gas supply is eliminated, dry chemical, Carbon Dioxide (CO2), and/or inert gas (Nitrogen, Halon, etc) may be used to extinguish adjacent burning materials

FIRE FIGHTING

Gas fires should not be extinguished until the gas flow can be stopped Shut off the gas source and allow the fire to burn itself out If the source cannot be shut off immediately, all equipment and surfaces exposed to the fire should be cooled with water to prevent over-heating, flash-backs, or explosions Control the fire until the gas supply can be shut off

Do not enter any enclosed or confined fire space without proper protective clothing and equipment. This may include a self-contained breathing apparatus to protect against the hazardous effects of combustion products and/or Oxygen deficiencies. If firefighters cannot work upwind to the fire, respiratory protective equipment must be worn. Cool tanks and containers exposed to fire with water Withdraw immediately in case of rising sound from venting safety device or discoloration of the vessel, tank, or pipeline Immediately notify the appropriate authorities if cryogenic liquid(s) enter sewers or waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS

Small Spills

Extremely Flammable Liquefied Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area upwind. Remove all potential ignition sources. Safety stop the source gas flow using non-sparking tools. Ventilate enclosed areas to prevent formation of flammable or Oxygen-deficient atmospheres. Closed gas systems form white-colored frost at the point of a leak. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Water spray may be used to reduce vapors. Avoid entering a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing.

Large Spills

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas/liquid or waste mixtures containing this gas/liquid should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING and STORAGE**Handling**

Use only with adequate ventilation/personal protection. Do NOT breathe vapor. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of Petroleum gases. If upon initial receipt inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Large pressure build-up can cause explosive decomposition at the cylinder head or release valve. The cylinder or other container will rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when handling gas/liquids.

Storage

Flammable gas/liquids should be stored in a separate safety storage cabinet or room. Keep away from heat and all other ignition sources! Keep containers tightly closed, plainly labeled, out of closed vehicles, and in a cool, well-ventilated place. A well ventilated, refrigerated room is preferable for materials with flash points lower than 70°F (AP 21°C). Containers should be able to withstand pressures expected from warming or cooling in storage. Do not puncture or incinerate containers. Do NOT contact with oxidizable materials. All electrical equipment in storage and/or handling areas should be installed in accordance with applicable requirements of the National Electrical Code and National Fire Protection Association standards.

Always chain cylinders securely and avoid placing them in high-traffic areas and away from falling objects. To prevent container damage, avoid dragging, rolling, sliding, or knocking cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and unneeded partially-filled containers should be returned to the supplier as soon as possible.

SECTION 8: EXPOSURE CONTROLS and PERSONAL PROTECTION**ENGINEERING CONTROLS**

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. Ensure that an emergency eyewash station and safety shower are proximal to the work-station location.

PERSONAL PROTECTIVE EQUIPMENT

- *Protective Equipment*

- *Eye Protection* Use chemical-type goggles and face shield when handling liquefied gases. Safety glasses with side shields and/or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.
- *Skin Protection*
 - *Hands* Use insulated, impervious, chemical-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.
 - *Body* Prevent potential skin contact with cold liquid, solid, or vapors. Use insulated, impervious, chemical-resistant clothing and equipment (apron, slicker suit, Tyvek, boots, etc.) to protect other potential skin contact areas.
- *Respiratory Protection* Odor is not an adequate warning for potentially hazardous air concentrations! For unknown vapor concentrations use a self-contained breathing apparatus (SCBA). For known vapor concentrations, above the 1,000 ppm exposure guideline shown below in this Section, use a NIOSH/MSHA-approved organic vapor respirator, if adequate protection is provided. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent.
- *General Comments* **Warning!** Use of Hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate Oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

EXPOSURE GUIDELINES

Substance	Source	Date	Type	Value	Time
PENTANE	OSHA	1989	PEL	600 ppm	8 Hrs
PENTANE	OSHA	1989	STEL	750 ppm	15 Mins
PENTANE (ALL ISOMERS)	ACGIH	1976	TLV	600 ppm	8 Hrs
PENTANE (ALL ISOMERS)	ACGIH	1976	STEL	750 ppm	15 Mins

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquid		
Color	Colorless liquid/invisible vapor. Odor may be inadequate to warn of potential overexposure.		
Odor	Faint, unpleasant.		
pH	Not applicable		
Vapor Pressure	AP 15 to 21 psi., absolute at 100°F (38°C)	Viscosity	Not applicable
Vapor Specific Gravity	AP 2.49 when Air = 1.0 at 70°F	Melting/Freezing Pt.	AP -255° to -201°F at 14.7 psia
Volatile Characteristics	Complete (100 Wt.%)	Solubility in Water	Slight (0.1 to 1 Wt.%)
Boiling Point/Range	AP 82° to 97°F (28° to 36°C) at 14.7 psia. (ASTM D-2887.)	Specific Gravity	AP 0.62 to 0.63 at 60°F.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 20,900 Btu/lb or 4,000 Btu/cu ft.		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable
Conditions to Avoid	Keep away from heat, sparks, open flame, and strong oxidizing conditons
Incompatibility with Other Materials	Strong acids, alkalies, and oxidizers such as Oxygen (gas or liquid), Chlorine, Flourine and Flouride compounds, Bromine, and metal catalysts.
Hazardous Decomposition Products	Burning or excessive heating may produce smoke, Carbon Monoxide, Carbon Dioxide, and possibly other harmful gases/vapors
Hazardous Polymerization	Not expected to occur

SECTION 11: TOXICOLOGICAL INFORMATION

Inhalation of 500 ppm **Isopentane** or **n-Pentane** have been reported NOT to produce any ill effects in humans. Also, inhalation of 5,000 ppm **n-Pentane** for 10 minutes has been reported NOT to produce any ill effects, but, higher concentrations of 90,000 to 120,000 ppm (9 to 12 Wt.% in air) have caused CNS depression and narcosis. Approximately 130,000 ppm can be fatal.

ISOPENTANE (2-METHYLBUTANE)

GAS (LCLo)	Acute 420,000 mg/M3 (Mouse) (2 hours) - Excitement
28-DAY ORAL (TDL0)	Subchronic 10,000 mg/kg (Rat) - Weight loss or decreased weight gain and some deaths.

PENTANE (n-PENTANE)

GAS (LCLo)	Acute: 325,000 mg/M3 (Mouse) (2 hours)
GAS (LC50)	Acute: 365,000 mg/M3 (Rat) (4 hours)
GAS (TCLo)	Acute: 100,000 ppm (Rabbit screen level) (4 hours) - Cardiac sensitization.
INTRAVENOUS (LC50)	Acute 445 mg/kg (Mouse)
28-DAY ORAL (TCLo)	Subchronic. 10,000 mg/kg (Rat) - Weight loss or decreased weight gain, especially in the bladder

SECTION 12: ECOLOGICAL INFORMATION

Ecological effects testing has not been conducted on this product. If it were spilled, no significant detrimental effects would be expected to occur.

Pentanes are only slightly soluble in water, and therefore, this product will not likely cause harm to aquatic life. It will normally evaporate rapidly if spilled.

SECTION 13: DISPOSAL CONSIDERATIONS

When it becomes necessary to dispose of this gas, it is preferable to do so as a vapor. It may be used as an auxillary fuel or disposed of by burning in a properly designed flare or incinerator. Venting of this gas to the atmosphere should be avoided.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U S Department of Transportation regulated material		
Proper Shipping Name	Pentanes		
Hazard Class	3		
UN/NA ID	UN1265	Packing Group(s)	PG I
Reportable Quantity	Not applicable		
Placards		Emergency Response Guide Number	128
		HAZMAT STCC Number	49 081 92
		MARPOL III Status	This product is NOT a "Marine Pollutant"

SECTION 15: REGULATORY INFORMATION

TSCA	All components of this product are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on Reportable Quantities (RQs) in 40 CFR 355 (used for SARA 302, 304, 311 and 312). No chemical components present in this product exceed the de minimus reporting level established under this statute
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This product would be classified under the following hazard categories: Immediate (Acute) and Delayed (Chronic) Health Hazards; Fire Hazard; and Sudden Release of Pressure Hazard.
SARA 313	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of annual release of " Toxic Chemicals " that appear in 40 CFR 372.65 (used for SARA 313). This information must be included in all MSDSs that are copied and distributed for this material. No chemical components present in this product are subject to the reporting requirements under this statute
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of " Hazardous Substances " equal to or greater than the " Reportable Quantities (RQs) " listed in 40 CFR 302.4. No chemical components present in this product are subject to the reporting requirements under this statute
California Proposition 65	Per the California Safe Drinking Water and Toxics Enforcement Act of 1986 , this product DOES NOT contain any of the ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm, which requires a warning under the statute
Additional Regulatory Remarks	The Federal Hazardous Substances Act , related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13). This product contains " Petroleum Distillates " which require special labeling if distributed in a manner intended, or packaged in a form suitable, for use in the household or by children. Precautionary label dialogue must display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! KEEP OUT OF REACH OF CHILDREN! DO NOT SIPHON BY MOUTH!

Clean Air Act - Section 111 (40 CFR 60.489): The EPA classifies the following Gasoline components as "**Volatile Organic Compounds**" which "contribute significantly to air pollution that endangers public health and welfare" ISOPENTANE and N-PENTANE

SECTION 16: OTHER INFORMATION

HMIS (U.S.A.)

Health Hazard	2
Fire Hazard	4
Reactivity	0

* = Chronic Health Hazard

National Fire Protection Association (U.S.A.)



DISCLAIMER OF LIABILITY

"THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS.

SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

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REVISION INFORMATION

Version Number 05
Revision Date 11/01/06
Revision History Logo and Manufacturer name change.

ABBREVIATIONS

EQ = Equal LT = Less Than GT = Greater Than
AP = Approximately NA = Not Applicable ND = No Data

***** END OF MSDS *****

TOLUENE BLEND STOCK

 APO15Z
 HFR# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: TOLUENE BLEND STOCK

Number: 000000000000016083

Chemical characterization: C7-C8 Aromatic Hydrocarbons

CAS-No.: 64742-95-6

Chemical Name: Solvent naphtha (petroleum), light aromatic.

Synonyms: Toluene/Ethylbenzene/Xylenes-Rich Naphtha, Gasoline Blending Component, Mixed Xylenes, Xylene Isomers, Ethylbenzene, and Toluene, Light Aromatic Solvent Naphtha (Petroleum), C7-C8 Alkylbenzenes, Dimethylbenzenes, Ethylbenzene, and Toluene, C7-C8 Aromatic Hydrocarbon Solvent

Company Address

 Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

 Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

 CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

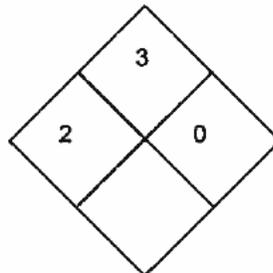
Signal Word

DANGER.

Hazards

Highly flammable. Heavier than air, vapors may travel long distances along the ground before igniting and flash back to vapor source. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. May cause eye and skin irritation. Exposure to vapor may cause central nervous system depression (fatigue, dizziness, headache, collapse, coma and death) and, possibly, cardiac sensitization. Affects central nervous system. May effect hearing. Possible cardiac sensitizer. May cause developmental toxicity. May cause cancer.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state

liquid

TOLUENE BLEND STOCK

Color

Colorless.

Odor

Characteristic. Sweet aromatic.

Odor Threshold

Specific data not available.

Potential health effects
Routes of exposure

Skin. Inhalation. Eye.

Acute effects

See component summary.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *m-Xylene 108-38-3*

Harmful by inhalation and if swallowed. Inhalation of vapors may cause respiratory distress and CNS effects. This material may be absorbed through the skin.

- *o-Xylene 95-47-6*

Harmful by inhalation and if swallowed. Inhalation of vapors may cause respiratory distress and CNS effects. This material may be absorbed through the skin.

- *p-Xylene 106-42-3*

Harmful by inhalation and if swallowed. Inhalation of vapors may cause respiratory distress and CNS effects. This material may be absorbed through the skin.

Chronic effects

See component summary.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *m-Xylene 108-38-3*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated or prolonged exposure may result in liver damage. May effect hearing.

- *o-Xylene 95-47-6*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated or prolonged exposure may result in liver damage. May effect hearing.

- *p-Xylene 106-42-3*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated or prolonged exposure may result in liver damage. May effect hearing.

TOLUENE BLEND STOCK

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Toluene	108-88-3	203-625-9	1.0 <= 95.0
Ethyl Benzene	100-41-4	202-849-4	0.0 <= 50.0
m-Xylene	108-38-3	203-576-3	0.0 <= 55.0
o-Xylene	95-47-6	202-422-2	0.0 <= 30.0
p-Xylene	106-42-3	203-396-5	0.0 <= 30.0

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. Never use low boiling point naphthas for washing contaminated skin. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

Notes to physician

Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard. Inhalation may cause CNS depression. Overexposure may produce anesthetic or narcotic effects. Do not induce vomiting. Risk of damage to lungs exceeds poisoning risk. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material.

5. FIRE-FIGHTING MEASURES



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

5 - 15 °C (41 - 59 °F) Tag closed cup ASTM D 56

Autoignition temperature

432 - 455 °C (809.6 - 851 °F)

Lower explosion limit

1.4 vol%

Upper explosion limit

7.6 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Dry chemical. CO₂. Water spray. Foam. Sand. LARGE FIRES: Water spray. Water fog. Foam. Dry chemical. CO₂. Sand.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. Releases flammable vapors below normal ambient temperatures. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Prevent fire extinguishing water from contaminating surface water or the ground water system. When fighting a fire, notify environmental authorities if liquid enters sewers or public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon monoxide and other toxic vapors.

Hazardous combustion products

Thermal decomposition may generate carbon monoxide, carbon dioxide, and perhaps other toxic vapors.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Extinguish all ignition sources. Stop leak if you can do it without risk. Evacuate/limit access. Restrict water use for cleanup. Notify fire and environmental authorities. Note: recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken. A vapor suppressing foam may be used to reduce vapors. DO NOT use water jet. Use clean non-sparking tools to collect absorbed material. On water, material is insoluble and floats. On water, contain/minimize dispersion/collect. Remove from surface water (e.g. by skimming or siphoning). The use of dispersants should be advised by an expert, and, if required, approved by local authorities.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Spills and leaks

Liquids/vapors may ignite. Contain/collect rapidly to minimize dispersion. Prevent spreading of vapors through sewers, ventilation systems and confined areas. Do not touch or walk through spilled material. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.

Prevent entry into waterways, sewers, basements or confined areas. If the product contaminates rivers and lakes or drains inform respective authorities. On water, material is insoluble and floats.

7. HANDLING AND STORAGE

Handling

Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Extinguish all ignition sources. Containers must be properly grounded before beginning transfer. Use only non-sparking tools. Check atmosphere for explosiveness and oxygen deficiencies. Carefully vent any internal pressure before removing closure. Observe precautions pertaining to confined space entry. Do not use compressed air for filling, discharging or handling. Handle empty containers with care; vapor residue may be flammable/explosive. Decontaminate containers thoroughly before reuse/disposal. Isolate, vent, drain, wash and purge systems or equipment before maintenance or repair. All equipment must conform to applicable electrical code. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Electrostatic charges may be generated as a result of flow or agitation.

Storage

Store only in tightly closed, properly vented containers away from heat, sparks, open flame and strong oxidizing agents. Store closed drums with bung in up position. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Electrical installations / working materials must comply with the technological safety standards. Keep container tightly closed and properly labeled. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. The type of respiratory protection will depend upon whether the maximum exposure concentration is known.

Consider the maximum period for wear. Where engineering controls are not feasible or sufficient to achieve full conformance with exposure limits (Section 8), use NIOSH approved respiratory protection equipment. Respirators should be selected based on the form and concentration of contaminant in air and in accordance with OSHA (29 CFR 1910.134).

Skin

Wear insulated gloves if contact with liquid is possible. Wear chemical resistant gloves such as: Glove material fluoroelastomer; material thickness 0.4 mm; break through time \geq 480 min. Gloves must be replaced after 8 hours of wear. The suitability for a specific workplace should be discussed with the producers of the protective gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Choose body

TOLUENE BLEND STOCK

Skin

protection according to the amount and concentration of the dangerous substance at the work place. Use PPE that is chemical resistant to the product and prevents skin contact. Fire retardant clothing is appropriate for routine occupational use.

Eyes

Safety glasses with side-shields Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid.

Remarks

Wash hands before eating, drinking, smoking, or using toilet facilities. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Use good personal hygiene practices.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Toluene	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.
Ethyl Benzene	US (ACGIH)	STEL	125 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
	NIOSH	IDLH	800 ppm	None.
m-Xylene	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	NIOSH	IDLH	900 ppm	None.
o-Xylene	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	NIOSH	IDLH	900 ppm	None.
p-Xylene	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	NIOSH	IDLH	900 ppm	None.

TOLUENE BLEND STOCK**9. PHYSICAL AND CHEMICAL PROPERTIES**

Appearance: liquid Colorless.

Odor: Characteristic. Sweet aromatic.

Odor Threshold: Specific data not available.

pH: not applicable

Boiling point/boiling range: 110 - 145 °C (230 - 293 °F)

Melting point/freezing point: Not applicable.

Flash point: 5 - 15 °C (41 - 59 °F) Tag closed cup ASTM D 56

Autoignition temperature: 432 - 455 °C (809.6 - 851 °F)

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: 1.4 vol%

Upper explosion limit: 7.6 vol%

Explosive properties: Not explosive

Oxidizing properties: Not considered an oxidizing agent.

Vapor pressure: 4 - 240 kPa @ 37.8 °C (100.04 °F)

Evaporation rate: No Data Available.

Relative density: 0.88 @ 15 °C (59 °F) (Water = 1)

Relative vapor density: 4 - 240 @ 37.8 °C (100.04 °F)(Air = 1.0)

Viscosity: < 3 mPa.s @ 40 °C (104 °F)

< 3 mm²/s @ 37.8 °C (100.04 °F)

Water solubility: no data available

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks, open flames and strong oxidizing conditions.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Incomplete combustion can result in the production of carbon monoxide, carbon dioxide and other toxic gases.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

See component summary.

COMPONENT INFORMATION

- *Toluene* 108-88-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
<u>LD50 (Oral)</u>	rat	5,580 MG/KG BWT	
<u>LD50 (Skin)</u>	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight, increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *Ethyl Benzene 100-41-4*

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of ≥ 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK \pm locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *m-Xylene* 108-38-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	5984 PPM	6 HOURS
	mouse	5267 PPM	6 HOURS

<u>LD50 (Oral)</u>	rat	6661 MG/KG BW
--------------------	-----	---------------

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

concentrations. Exposure to high vapor concentrations may cause effects on hearing.

Ingestion

May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). Possible cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Skin absorption hazard. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure). Expected to have a low order of acute dermal toxicity based on component toxicity information. Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

May be irritating to the skin. Repeated and/or prolonged contact with skin may cause inflammation, hyperkeratosis, acanthosis and ulceration.

Eyes

May cause moderate to severe eye irritation.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Hearing. Central nervous system. Liver. Kidneys. Cardiac sensitization.

Repeated dose toxicity

Repeated inhalation exposure of rats to m-xylene caused slight changes in liver histopathology and CNS (behavioral) effects at \Rightarrow 100 ppm (0.43 mg/L) but no ototoxicity at 1800 ppm (7.82 mg/L). Oral exposure of rats to m-xylene for 13 weeks produced decreased body weight gains in males at \Rightarrow 200 mg/kg bwt/day and in females at \Rightarrow 800 mg/kg bwt/day; and exposure to 2000 mg/kg bwt/day for 10 days produced increases in liver weights. No ototoxicity was observed in rats exposed orally to m-xylene at 1798 mg/kg bwt/day. The observed liver effects may be adaptive rather than adverse effects.

Reproductive effects

No effect on testicular weight was found in rats exposed by inhalation to 100 ppm (0.43 mg/L) m-xylene for 13 weeks. No damage to reproductive organs was noted in rats exposed by oral gavage to m-xylene at 800 mg/kg bwt/day for 13 weeks.

Developmental Toxicity

May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to m-xylene was reported to produce decreases in fetal weight and a slight decrease in implantations at 700 ppm (3.0 mg/L) in the presence of maternal toxicity (decreased body weight gain and feed consumption, increased relative liver weight). After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to 2580 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity

m-Xylene produced negative results in assays for gene mutation in bacteria, recessive lethal mutations in the fruit fly, and induction of micronuclei in mouse bone marrow after intraperitoneal injection.

Carcinogenicity

Available data for mixed xylenes indicate that m-xylene is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

- *o*-Xylene 95-47-6

Acute toxicity

rat	4,330 PPM (PREDICTED)	6 HOURS
mouse	3,907 PPM (PREDICTED)	6.0 HOURS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

LD50 (Oral) rat 3,523 MG/KG (PREDICTED)
 mouse >= 5,251 MG/KG (PREDICTED)

LD50 (Skin) rabbit >4.350 MG/KG (PREDICTED)

Acute effects

Inhalation

This substance has a low order of acute toxicity by the inhalation route. Inhalation of vapors may cause signs of respiratory tract irritation (cough and difficulty breathing), CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure), possible cardiac sensitization, and irritation of the eyes and throat. Exposure to high vapor concentrations may cause effects on hearing.

Ingestion

This substance is of low acute toxicity when administered orally. May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys; CNS depression (primarily fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe overexposure), and possible cardiac sensitization. Aspiration into the lung may cause fatal chemical pneumonitis.

Skin contact

Skin absorption hazard. Repeated contact with skin may cause cracking and/or fissuring. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure).

Irritation

Skin

May be irritating to the skin. Repeated contact with skin may cause cracking and/or fissuring.

Eyes

Mild to moderate irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Hearing. Central nervous system. Liver. Kidneys. Cardiac sensitization.

Repeated dose toxicity

May be toxic following repeated exposure to high doses. Repeated inhalation exposure of rats to o-xylene caused a reduction in body weight and liver effects (increase in weight, enzyme changes, cell proliferation, and histopathology) at ≥ 1090 ppm (4.73 mg/L), but no ototoxicity at 1800 ppm (7.82 mg/L). Oral exposure of rats for 10 days to o-xylene produced increases in liver weights and decreases in body weights at 2000 mg/kg bwt/day. The observed liver effects may be adaptive rather than adverse effects.

Reproductive effects

Not expected to cause reproductive toxicity. Available information from studies conducted in laboratory animals with similar substances (mixed xylenes, m- and p-xylene) shows no evidence of an effect on reproductive performance or reproductive organs at high inhalation or oral doses. Mixed xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses. None.

Developmental Toxicity

May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to o-xylene was reported to produce decreases in fetal weight at ≥ 350 ppm (1.5 mg/L) and increases in skeletal variations, but not malformations, at 2000 ppm (8.7 mg/L), in the presence of maternal toxicity (decreased body weight gain and feed consumption, increased relative liver weight). After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to 1935 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity

o-Xylene produced negative results in assays for gene mutation in bacteria, recessive lethal mutations in the fruit fly, and induction of micronuclei in mouse bone marrow or changes in sperm morphology in rats after intraperitoneal injection.

Carcinogenicity

Available data for mixed xylenes indicate that o-xylene is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

- *p*-Xylene 106-42-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	4740 PPM	4 HOURS
<u>LC50 (Inhl)</u>	mouse	3907 PPM	6 HOURS
<u>LD50 (Oral)</u>	rat	4,029 MG/KG	
<u>LD50 (Skin)</u>	rabbit	(predicted) > 4,350 MG/KG	

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations. Exposure to high vapor concentrations may cause effects on hearing.

Ingestion

May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). Possible cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Skin absorption hazard. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure). Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

May be irritating to the skin. Repeated contact with skin may cause cracking and/or fissuring.

Eyes

May cause eye irritation.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Hearing. Central nervous system. Liver. Kidneys. Cardiac sensitization.

Repeated dose toxicity

May be toxic following repeated exposure to high doses. No standard repeated inhalation exposure study is available. However, in limited scope studies, repeated inhalation exposure of rats to *p*-xylene caused ototoxicity at ≥ 900 ppm (3.91 mg/L) but not at 450 ppm (1.95 mg/L). Repeated inhalation exposures of laboratory animals to other xylene isomers and/or mixed xylenes caused reduced body weight/weight gain at ≥ 1000 ppm (4.35 mg/L), liver and CNS (behavioral) effects at ≥ 100 ppm (0.43 mg/L), and, in rats, ototoxicity at ≥ 250 ppm (1.09 mg/L). No treatment-related effects were seen in rats after oral exposure to *p*-xylene at 800 mg/kg bwt/day for 13 weeks. Short-term (10-14 days) repeated oral exposure of rats to *p*-xylene produced increases in liver weights and decreases in body weights and relative thymus weights at 2000 mg/kg bwt/day, and ototoxicity at 899 mg/kg bwt/day (the only concentration tested for ototoxicity). No ototoxicity was observed in guinea pigs exposed to *p*-xylene at this dose level. Oral exposure of rats to mixed xylenes at 500 mg/kg bwt/day for 103 weeks produced only slightly decreased body weight. Repeated oral exposure of mice to mixed xylenes produced a reduction in body weight in females at 2000 mg/kg bwt/day for 13 weeks, but no treatment-related effects were seen after exposure to 1000 mg/kg bwt/day for 103 weeks. The observed liver effects may be adaptive rather than adverse effects.

Reproductive effects

This substance is not expected to be a reproductive toxicant. No damage to reproductive organs was noted in rats exposed by oral gavage to *p*-xylene at 800 mg/kg bwt/day for 13 weeks. Results for mixed xylenes in a one-generation reproductive toxicity study (rats, inhalation at 500 ppm/2.17 mg/L) and two dominant lethal studies (rats, i.p.; mice, s.c.; 864 mg/kg bwt), and from evaluation of reproductive organs in repeated dose studies (male rats, inhalation, 1000 ppm [4.35 mg/L]; rats



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

[1000 mg/kg bwt/day] and mice [2000 mg/kg bwt/day, oral] indicate that mixed xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at high inhalation or oral doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to p-xylene was reported to produce decreases in fetal weight and increases in post implantation loss at ≥ 700 ppm (3.0 mg/L), and increases in skeletal variations, but not malformations, at 2000 ppm (8.7 mg/L) in the presence of maternal toxicity (decreased body weight gain and feed consumption, and increased relative liver weight). No effect on neurobehavior was noted in offspring of rat dams exposed to 800 and 1600 ppm (3.5 or 7.0 mg/L) prenatally. After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to p-xylene at ≥ 1935 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity

Not expected to be genotoxic. p-Xylene produced negative results in assays for gene mutation in bacteria and induction of micronuclei in mouse bone marrow after intraperitoneal injection. Two positive responses have been reported for mixed xylenes, but the overall weight of evidence from a variety of in vitro and in vivo genotoxicity studies with xylenes indicates that these substances are not genotoxic.

Carcinogenicity

Available data for mixed xylenes indicate that p-xylene is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

See component summary.

Acute Fish toxicity

/ 96 HOURS Pimephales promelas (fathead minnow) 8.2 mg/l

Environmental fate and pathways

See component summary.

Mobility

Behavior in environmental compartments: Partitioning mainly to air.

Predicted distribution to environmental compartments: The substance is a hydrocarbon UVCB. The product will be dispersed amongst the various environmental compartments (soil/ water/ air).

Persistence and degradability

Bioaccumulation: The substance is a hydrocarbon UVCB.

COMPONENT INFORMATION

- Toluene 108-88-3



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 55 mg/l

LC50 / 96 HOUR Carassius auratus 22.8 mg/l

LC50 / 96 HOUR Pimephales promelas 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR Daphnia magna. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY Daphnia magna. 1.0 mg/l

NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Ethyl Benzene* 100-41-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 4.2 mg/l

LC50 / 96 HOUR Menidia menidia 5.1 mg/l

LC50 / 96 HOUR Poecilia reticulata 9.6 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna* 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* (green algae) 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* (green algae) 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *m-Xylene* 108-38-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 8.4 mg/l

Acute toxicity to aquatic invertebrates

LC50 / 48 HOURS *Daphnia magna* (Water flea) 4.7 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Selenastrum capricornutum* (green algae) 4.9 mg/l

Chronic toxicity to fish

NOEC / 56 d *Oncorhynchus mykiss* (rainbow trout) 1.3 mg/l

Summary: (predicted; mixed xylenes)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Chronic toxicity to aquatic invertebrates

NOEC / 7 d Ceriodaphnia (water flea) 1.17 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Readily biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.

Bioaccumulation: Significant bioaccumulation is not expected.

- *o*-Xylene 95-47-6

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 7.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS Daphnia magna (Water flea) 1 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Selenastrum capricornutum (green algae) 4.7 mg/l

Toxicity to microorganisms

EC50 / 0.5 HOURS Activated sludge 70 mg/l

Chronic toxicity to fish

NOEC / 56 d Oncorhynchus mykiss (rainbow trout) 1.3 mg/l

Summary: (predicted; mixed xylenes)

Chronic toxicity to aquatic invertebrates

NOEC / 7 d Ceriodaphnia (water flea) 1.17 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Some volatilization from water or soil surfaces is expected, with *o*-xylene initially partitioned mainly to soil and water. Expected to exist solely as a vapor in the ambient atmosphere.

Persistence and degradability

Biodegradation: Inherently biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.

Bioaccumulation: Significant bioaccumulation is not expected.

- *p*-Xylene 106-42-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 2.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS Daphnia magna (Water flea) 3.6 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Selenastrum capricornutum (green algae) 4.4 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Toxicity to microorganisms

NOEC / 3 HOURS Activated sludge 157 mg/l

Chronic toxicity to fish

NOEC / 56 d Oncorhynchus mykiss (rainbow trout) 1.3 mg/l

Summary: (predicted; mixed xylenes)

Chronic toxicity to aquatic invertebrates

NOEC (reproduction) / 21 d Daphnia magna (Water flea) 1.57 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Some volatilization from water or soil is expected, with p-xylene initially partitioned mainly to soil and water

Persistence and degradability

Biodegradation: This material is expected to be readily biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.

Bioaccumulation: Significant bioaccumulation is not expected. Fish BCF (Anguilla japonica) 23.6 after 10 days (mixed xylenes); BCF (Carassius auratus) 14.8 (xylene isomer).

13. DISPOSAL CONSIDERATIONS

Contaminated product, soil, water, and empty containers may be hazardous wastes due to possible presence of flammable gases. Assure emissions comply with applicable regulations. Preferred disposal for this volatile, flammable product is through combustion. Use flare if pressure warrants. Proper grounding procedures to avoid static electricity should be followed. The product should not be allowed to enter drains, water courses or the soil.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Petroleum distillates, n.o.s. (TOLUENE, XYLENES)

Reportable quantity ETHYLBENZENE

ID No. UN1268

Hazard class 3

Packing group II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

Japan	ENCS/ISHL
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.
 Not Listed.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Toluene		1000 lbs
Ethyl Benzene		1000 lbs
m-Xylene		1000 lbs
o-Xylene		1000 lbs
p-Xylene		100 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
Toluene	1.0%
Ethyl Benzene	0.1%
m-Xylene	1.0%
o-Xylene	1.0%
p-Xylene	1.0%

State Reporting

Known to the State of California to cause cancer.

100-41-4 Ethyl Benzene (December 11, 2009)

Known to the State of California to cause birth defects.

108-88-3 Toluene (December 11, 2009)

Known to the State of California to cause reproductive toxicity in females.

108-88-3 Toluene (December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

108-88-3 Toluene
 100-41-4 Ethyl Benzene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE85
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 11/30/2011

TOLUENE BLEND STOCK

108-38-3 m-Xylene
 95-47-6 o-Xylene
 106-42-3 p-Xylene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

108-88-3 Toluene
 100-41-4 Ethyl Benzene
 108-38-3 m-Xylene
 95-47-6 o-Xylene
 106-42-3 p-Xylene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

108-88-3 Toluene
 100-41-4 Ethyl Benzene
 108-38-3 m-Xylene
 95-47-6 o-Xylene
 106-42-3 p-Xylene

Labeling

Other

No additional information available.

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. November 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

TOLUENE BLEND STOCK

MSDS No.: BE85
Variant: U.S.A.-EN
Revision: 1.0
Validation Date: 11/30/2011



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

AP0184
 HFR# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: BT RAFFINATE

Number: 00000000000017966

Chemical characterization: C5 - C8 Petroleum Hydrocarbons

CAS-No.: 64741-84-0

Chemical Name: Naphtha (petroleum), solvent-refined light

Synonyms: Benzene/ Toluene Unit Raffinate; BTU Raffinate; Gasoline Blending Component; Light Aliphatic Naptha from a Sulfolane BTX Extraction, BTU AS-111 Extractor Column Overhead; BTU AS112 Raffinate Waster Wash column Overhead,; Rubber Solvent Naphtha; Low-benzene Solvent; C5 - C8 Hydrocarbon Solvent; Ligroin (Petroleum);, Solvent - refined Light Naphtha (Petroleum).

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

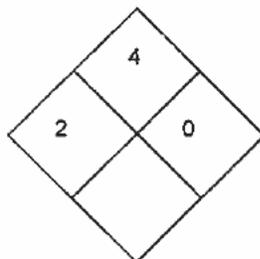
Signal Word

DANGER.

Hazards

Extremely flammable liquid. Heavier than air, vapors may travel long distances along the ground before igniting and flash back to vapor source. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. May cause eye and skin irritation. Irritating to the respiratory system. May cause drowsiness and dizziness. Exposure to vapor may cause central nervous system depression (fatigue, dizziness, headache, collapse, coma and death) and, possibly, cardiac sensitization. Possible reproductive toxin. May cause cancer.

NFPA®



HMIS®

Health	2
Flammability	3
Physical Hazard	0

Physical state

liquid



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Color

transparent colorless

Odor

Gasoline or naphtha odor. characteristic

Odor Threshold

No Data Available.

Potential health effects

Routes of exposure

Skin. Inhalation. Eye.

Acute effects

See component summary.

- *Octane Isomers*

May be irritating to the skin. Aspiration hazard. CNS depressant.

- *Heptane isomers*

CNS depressant. Aspiration hazard.

- *n-Hexane 110-54-3*

May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. May be irritating to the skin. High or repeated exposures can damage the peripheral nervous system, causing numbness, tingling, and/or muscle weakness in the hands or feet. The onset of health effects associated with n-hexane may be influenced by exposure to additional chemicals such as methyl isobutyl ketone and methyl ethyl ketone.

- *Methylcyclopentane 96-37-7*

This product may cause eye, skin, and respiratory tract irritation. High concentrations may cause central nervous system (CNS) depression. Ingestion would likely cause gastrointestinal tract irritation.

- *Cyclohexane 110-82-7*

CNS depressant. Simple asphyxiant. May be irritating to the eyes, skin, and respiratory system.

- *n-Pentane 109-66-0*

Aspiration hazard. May cause central nervous system depression.

- *Cyclopentane 287-92-3*

Aspiration hazard. May cause central nervous system depression.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Methyl Cyclohexane 108-87-2*

Liquid, mist, or vapors can cause eye, skin and respiratory tract irritation. CNS depressant. Exposure to excess vapor may cause headache, fatigue, drowsiness and dizziness.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *o-Xylene 95-47-6*

Harmful by inhalation and if swallowed. Inhalation of vapors may cause respiratory distress and CNS effects. This material may be absorbed through the skin.

- *m-Xylene 108-38-3*

Harmful by inhalation and if swallowed. Inhalation of vapors may cause respiratory distress and CNS effects. This material may be absorbed through the skin.

- *n-Heptane 142-82-5*

CNS depressant. Aspiration hazard.

- *p-Xylene 106-42-3*

Harmful by inhalation and if swallowed. Inhalation of vapors may cause respiratory distress and CNS effects. This material may be absorbed through the skin.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

BT RAFFINATE

- *n-Butane 106-97-8*

Simple asphyxiant. Inhalation of vapors may cause dizziness, narcosis, nausea or asphyxiation. CNS depressant.

Chronic effects

See component summary.

- *Octane Isomers*

Lungs may be affected by repeated or prolonged exposure.

- *Heptane isomers*

Repeated or prolonged exposure to styrene may cause nausea, loss of Appetite, CNS depression, and general weakness.

- *n-Hexane 110-54-3*

Damage to nerves in hands or feet may occur from prolonged inhalation of *n*-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm *n*-hexane can produce progressively worsening damage to the peripheral nerves. Prolonged and repeated exposure to vapors may cause damage to the CNS, lungs and kidneys. Suspect reproductive hazard.

- *Methylcyclopentane 96-37-7*

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

- *Cyclohexane 110-82-7*

No adverse chronic human health effects have been reported for this material.

- *n-Pentane 109-66-0*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin.

- *Cyclopentane 287-92-3*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Methyl Cyclohexane 108-87-2*

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *o-Xylene 95-47-6*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated or prolonged exposure may result in liver damage. May effect hearing.

- *m-Xylene 108-38-3*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated or prolonged exposure may result in liver damage. May effect hearing.

- *n-Heptane 142-82-5*

No adverse chronic human health effects have been reported for this material.

- *p-Xylene 106-42-3*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated or prolonged exposure may result in liver damage. May effect hearing.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *n-Butane 106-97-8*

Repeated or prolonged exposure to low levels of this material produces no known adverse chronic health hazards.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Naphtha,petroleum, solvent-refined light	64741-84-0	265-086-6	>= 97.0
Hexane Isomers	Mixture	Isomeric Mixture	0.0 <= 65.0
Octane Isomers	Mixture	Isomeric Mixture	0.0 <= 65.0
Heptane isomers	Mixture	Isomeric mixture	0.0 <= 65.0
n-Hexane	110-54-3	203-777-6	10.0 <= 30.0
Methylcyclopentane	96-37-7	202-503-2	0.0 <= 30.0
Cyclohexane	110-82-7	203-806-2	0.0 <= 25.0
n-Pentane	109-66-0	203-692-4	0.0 <= 15.0
Cyclopentane	287-92-3	206-016-6	0.0 <= 15.0
Toluene	108-88-3	203-625-9	0.0 < 10.0
Methyl Cyclohexane	108-87-2	203-624-3	0.0 <= 10.0
Ethyl Benzene	100-41-4	202-849-4	0.0 <= 10.0
o-Xylene	95-47-6	202-422-2	0.0 <= 10.0
m-Xylene	108-38-3	203-576-3	0.0 <= 10.0
n-Heptane	142-82-5	205-563-8	0.0 <= 10.0
p-Xylene	106-42-3	203-396-5	0.0 <= 10.0
Benzene	71-43-2	200-753-7	0.0 <= 5.0
n-Butane	106-97-8	203-448-7	0.0 <= 5.0

Typical composition

See section 16 for full text of risk phrases.

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. Never use low boiling point naphthas for washing contaminated skin. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IA flammable liquid.

Flash point

< 23 °C (< 73.4 °F)

Autoignition temperature

232 °C (449.6 °F)

Lower explosion limit

1 vol%

Upper explosion limit

7.6 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Dry chemical. CO₂. Water spray. Foam. Sand. LARGE FIRES: Water spray. Water fog. Foam. Dry chemical. CO₂. Sand.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

When exposed to ignition source in air, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. Releases flammable vapors below normal ambient temperatures. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Prevent fire extinguishing water from contaminating surface water or the ground water system. When fighting a fire, notify environmental authorities if liquid enters sewers or public waters. Fire residues and contaminated fire



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Precautions for fire-fighting

Extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon monoxide and other toxic vapors.

Hazardous combustion products

Thermal decomposition may generate carbon monoxide, carbon dioxide, and perhaps other toxic vapors. May also include hydrogen sulfide, sulfur oxides or sulfuric acid.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Extinguish all ignition sources. Stop leak if you can do it without risk. Evacuate/limit access. Restrict water use for cleanup. Notify fire and environmental authorities. Note: recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken. A vapor suppressing foam may be used to reduce vapors. DO NOT use water jet. Use clean non-sparking tools to collect absorbed material. On water, material is insoluble and floats. On water, contain/minimize dispersion/collect. Remove from surface water (e.g. by skimming or siphoning). The use of dispersants should be advised by an expert, and, if required, approved by local authorities.

Liquids/vapors may ignite. Contain/collect rapidly to minimize dispersion. Prevent spreading of vapors through sewers, ventilation systems and confined areas. Do not touch or walk through spilled material. Water spray may reduce vapor, but may not prevent ignition in closed spaces. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.

Prevent entry into waterways, sewers, basements or confined areas. If the product contaminates rivers and lakes or drains inform respective authorities. On water, material is insoluble and floats.

7. HANDLING AND STORAGE

Handling

Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Extinguish all ignition sources. Containers must be properly grounded before beginning transfer. Use only non-sparking tools. Check atmosphere for explosiveness and oxygen deficiencies. Carefully vent any internal pressure before removing closure. Observe precautions pertaining to confined space entry. Do not use compressed air for filling, discharging or handling. Handle empty containers with care; vapor residue may be flammable/explosive. Decontaminate containers thoroughly before reuse/disposal. Isolate, vent, drain, wash and purge systems or equipment before maintenance or repair. All equipment must conform to applicable electrical code. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Use only bottom loading of tankers, in compliance with European regulations. Electrostatic charges may be generated as a result of flow or agitation. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products.

Storage

Store only in tightly closed, properly vented containers away from heat, sparks, open flame and strong oxidizing agents. Store closed drums with bung in up position. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Electrical installations / working materials must comply with the technological safety standards. Keep container tightly closed and properly labeled. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water.

BT RAFFINATE

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. The type of respiratory protection will depend upon whether the maximum exposure concentration is known.

Consider the maximum period for wear.

Skin

Wear chemical resistant gloves such as: Glove material fluoroelastomer; material thickness 0.4 mm; break through time \geq 480 min. Gloves must be replaced after 8 hours of wear. The suitability for a specific workplace should be discussed with the producers of the protective gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Choose body protection according to the amount and concentration of the dangerous substance at the work place. Use PPE that is chemical resistant to the product and prevents skin contact. Fire retardant clothing is appropriate for routine occupational use.

Eyes

Safety glasses with side-shields Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid.

Remarks

Wash hands before eating, drinking, smoking, or using toilet facilities. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Use good personal hygiene practices.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
n-Hexane	US (ACGIH)	TWA	50 ppm	None.
	US (OSHA)	TWA	500 ppm 1,800 mg/m ³	None.
	NIOSH	IDLH	1,100 ppm	None.
Cyclohexane	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	300 ppm 1,050 mg/m ³	None.
	NIOSH	IDLH	1,300 ppm	None.
Toluene	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

n-Pentane	US (ACGIH)	TWA	600 ppm	None.
	US (OSHA)	TWA	1,000 ppm 2,950 mg/m ³	None.
	NIOSH	IDLH	1,500 ppm	None.
Ethyl Benzene	US (ACGIH)	STEL	125 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
	NIOSH	IDLH	800 ppm	None.
Cyclopentane	US (ACGIH)	TWA	600 ppm	None.
Methyl Cyclohexane	US (ACGIH)	TWA	400 ppm	None.
	US (OSHA)	TWA	500 ppm 2,000 mg/m ³	None.
	NIOSH	IDLH	1,200 ppm	None.
	US (ACGIH)	STEL	500 ppm	None.
n-Heptane	US (ACGIH)	TWA	400 ppm	None.
	US (OSHA)	TWA	500 ppm 2,000 mg/m ³	None.
	NIOSH	IDLH	750 ppm	None.
	US (ACGIH)	STEL	2.5 ppm	None.
Benzene	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
	NIOSH	IDLH	500 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid transparent, colorless

Odor: Gasoline or naphtha odor. characteristic

Odor Threshold: No Data Available.

pH: not applicable

Boiling point/boiling range: 36 - 143 °C (96.8 - 289.4 °F)

Melting point/freezing point: -129 - -57 °C (-200.2 - -70.6 °F)

Flash point: < 23 °C (< 73.4 °F)

Autoignition temperature: 232 °C (449.6 °F)

Flammability: OSHA/NFPA Class IA flammable liquid.

Lower explosion limit: 1 vol%

Upper explosion limit: 7.6 vol%

Explosive properties: Not explosive

Oxidizing properties: Not considered an oxidizing agent.

Vapor pressure: 13.8 - 75.8 kPa @ 37.8 °C (100.04 °F)

Evaporation rate: 6 (butyl acetate = 1)

Relative density: 0.68 - 0.72 @ 15 °C (59 °F)

Relative vapor density: 3.5 @ 15.5 - 32.2 °C (59.9 - 89.96 °F)

Viscosity: < 2 mm²/s @ 37.8 °C (100.04 °F)

Water solubility: Negligible (Less Than .1 Percent).

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Conditions to avoid

Heat, sparks, open flame, other ignition sources, and oxidizing conditions.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Incomplete combustion can result in the production of carbon monoxide, carbon dioxide and other toxic gases.

Hazardous polymerization



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Hazardous polymerization
 Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary
 See component summary.

COMPONENT INFORMATION

- *Naphtha, petroleum, solvent-refined light 64741-84-0*

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

This substance produced irritant effects of corneal opacity, iris congestion, and moderate to severe conjunctival irritation.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Skin, central nervous system (CNS)

- *Hexane Isomers*

Other information

No data available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

- *Octane Isomers*

Acute effects

Ingestion

Harmful if swallowed.

Irritation

Skin

May be irritating to the skin.

- *Heptane isomers*

Target Organs

Central nervous system. Lung.

Repeated dose toxicity

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Hexane 110-54-3*

Acute toxicity

LC50 (Inhl) rat 48,000 PPM 4 HOURS

LD50 (Oral) rat 28,710 MG/KG

LD50 (Skin) rabbit 3000 MG/KG

Irritation

Eyes

Eye irritant.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Peripheral nervous system Testes.

Repeated dose toxicity

Rabbits exposed by inhalation to 3,000 ppm 8 hours/day for 8 days showed changes in the lungs, emphysema, necrosis of the bronchial epithelium, and atelectasis. Rats continuously exposed to 400 ppm developed anoxapathy, although intermittent exposure to 10,000 ppm 6 hours/day, 5 days/week for 13 weeks caused only mild paranodal axonal swelling. The offspring of rats and mice exposed orally or by inhalation to n-hexane during gestation showed depressed weight gain after birth. This agent also affects male and female reproductive capacity.

Reproductive effects

Exposure to n-hexane may damage the developing fetus.

Developmental Toxicity

Causes productive and embryotoxic effects and is cytotoxic in mammalian and human test systems.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

Exposure of humans to 5,000 ppm n-hexane for 10 minutes causes marked vertigo; exposure to 1,500 ppm results in headache and slight nausea. In industrial settings, exposure to levels exceeding 1,000 ppm have been reported to cause mild symptoms of narcosis. Eye and upper respiratory tract irritation has been reported to occur in humans exposed to 880 ppm n-hexane for 15 minutes. Dermal contact with n-hexane results in immediate irritation characterized by erythema and hyperemia; exposed subjects developed blisters 5 hours following dermal exposure to n-hexane. The neuropathic toxicity of n-hexane in humans is well documented; cases of polyneuropathy have typically occurred in humans chronically exposed to levels of n-hexane ranging from 400 to 600 ppm, with occasional exposures up to 2,500 ppm. Distal symmetrical motor weakness is common in most cases; however, in severely affected individuals, motor weakness may



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Other information

extend to the pelvic and high musculature. Nerve biopsies in affected individuals show swelling of the nerve and thinning of the myelin sheath. Functional neurological disturbances usually progress for a few months after termination of exposure. Although recovery is expected to occur within a year, clinical polyneuropathy has been reported in some cases to remain after 2 years. Blurred vision, restricted visual field, and optic nerve atrophy has been reported to occur in association with n-hexane-induced polyneuropathy.

- *Methylcyclopentane* 96-37-7

Target Organs

Skin. Eye. Respiratory system. Nervous system.

Repeated dose toxicity

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Cyclohexane* 110-82-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	13.9 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	> 5000 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 2000 MG/KG	

Target Organs

Central nervous system effects.

Repeated dose toxicity

No known chronic health effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Pentane* 109-66-0

Acute toxicity

<u>LC50 (Inhl)</u>	rat	> 18.02 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	> 2000 MG/KG BWT	
<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	

Target Organs

Respiratory system. Kidneys.

Repeated dose toxicity

No treatment-related effects were observed in a 90-day inhalation study in rats exposed to n-pentane at up to 6778 ppm (20 mg/L). Inhalation neurotoxicity evaluations in rats exposed to n-pentane at 3000 ppm (8.9 mg/L) for up to 30 weeks found no evidence of neurotoxicity. Repeated oral gavage exposures of rats to 500 mg/kg bwt/day n-pentane produced lethality, decreases in bodyweight gain and slightly lower kidney weights.

Reproductive effects

No effects on reproductive organs were observed in a 90-day inhalation study in rats exposed to n-pentane at ~7000 ppm (20 mg/L). n-Pentane was negative in a dominant lethal test in mice when males were given a single intraperitoneal injection of 48-666 mg/kg bwt.

Developmental Toxicity

No developmental toxicity was observed when pregnant rats were exposed to n-pentane by oral administration of 1000mg/kg bwt/day or by inhalation of 10000 ppm (29.5 mg/L).

Carcinogenicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Target Organs

Not listed by IARC, NTP, OSHA or EPA.

- *Cyclopentane* 287-92-3

Acute toxicity

LC50 (Inhl) rat 106 GM/M3

LD50 (Oral) rat 11,400 MG/KG

Acute effects

Inhalation

Specific data not available.

Ingestion

Specific data not available.

Skin contact

Specific data not available.

Irritation

Skin

Specific data not available.

Eyes

Specific data not available.

Target Organs

Skin. Central nervous system. Lung.

Repeated dose toxicity

Sensitive individuals may exhibit skin rash, wheezing, tightness of the chest, and difficulty breathing that may progress to a life-threatening inability to breathe.

Reproductive effects

No effects on reproductive organs were observed in a 90-day inhalation study with rats exposed to ~10,200 ppm (29.8 mg/L).

Genetic Toxicity

Cyclopentane was negative in the Ames Test and mouse lymphoma assay and in an in vivo micronucleus test, but induced chromosome aberrations in an in vitro mammalian cell assay.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

No data available.

- *Toluene* 108-88-3

Acute toxicity

LC50 (vapor) rat 7500 PPM 4 HOURS

LD50 (Oral) rat 5,580 MG/KG BWT

LD50 (Skin) Rabbit > 5000 MG/KG BWT

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

BT RAFFINATE

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *Methyl Cyclohexane* 108-87-2

Acute toxicity

LD50 (Oral) rat > 3,200 MG/KG

Irritation

Skin

May be irritating to the skin. Repeated or prolonged contact with skin may cause dermatitis.

Eyes

May cause eye irritation.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Ethyl Benzene* 100-41-4

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of \geq 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *o*-Xylene 95-47-6

Acute toxicity

rat	4,330 PPM (PREDICTED)	6 HOURS
mouse	3,907 PPM (PREDICTED)	6.0 HOURS

<u>LD50 (Oral)</u>	rat	3,523 MG/KG (PREDICTED)
	mouse	>= 5,251 MG/KG (PREDICTED)

<u>LD50 (Skin)</u>	rabbit	>4.350 MG/KG (PREDICTED)
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Acute effects

Inhalation

This substance has a low order of acute toxicity by the inhalation route. Inhalation of vapors may cause signs of respiratory tract irritation (cough and difficulty breathing), CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure), possible cardiac sensitization, and irritation of the eyes and throat. Exposure to high vapor concentrations may cause effects on hearing.

Ingestion

This substance is of low acute toxicity when administered orally. May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys; CNS depression (primarily fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe overexposure), and possible cardiac sensitization. Aspiration into the lung may cause fatal chemical pneumonitis.

Skin contact

Skin absorption hazard. Repeated contact with skin may cause cracking and/or fissuring. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure).

Irritation

Skin



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

May be irritating to the skin. Repeated contact with skin may cause cracking and/or fissuring.

Eyes

Mild to moderate irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Hearing. Central nervous system. Liver. Kidneys. Cardiac sensitization.

Repeated dose toxicity

May be toxic following repeated exposure to high doses. Repeated inhalation exposure of rats to o-xylene caused a reduction in body weight and liver effects (increase in weight, enzyme changes, cell proliferation, and histopathology) at ≥ 1090 ppm (4.73 mg/L), but no ototoxicity at 1800 ppm (7.82 mg/L). Oral exposure of rats for 10 days to o-xylene produced increases in liver weights and decreases in body weights at 2000 mg/kg bwt/day. The observed liver effects may be adaptive rather than adverse effects.

Reproductive effects

Not expected to cause reproductive toxicity. Available information from studies conducted in laboratory animals with similar substances (mixed xylenes, m- and p-xylene) shows no evidence of an effect on reproductive performance or reproductive organs at high inhalation or oral doses. Mixed xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses. None.

Developmental Toxicity

May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to o-xylene was reported to produce decreases in fetal weight at ≥ 350 ppm (1.5 mg/L) and increases in skeletal variations, but not malformations, at 2000 ppm (8.7 mg/L), in the presence of maternal toxicity (decreased body weight gain and feed consumption, increased relative liver weight). After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to 1935 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity

o-Xylene produced negative results in assays for gene mutation in bacteria, recessive lethal mutations in the fruit fly, and induction of micronuclei in mouse bone marrow or changes in sperm morphology in rats after intraperitoneal injection.

Carcinogenicity

Available data for mixed xylenes indicate that o-xylene is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

- *m-Xylene* 108-38-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	5984 PPM	6 HOURS
	mouse	5267 PPM	6 HOURS

<u>LD50 (Oral)</u>	rat	6661 MG/KG BW

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations. Exposure to high vapor concentrations may cause effects on hearing.

Ingestion

May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). Possible cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Skin absorption hazard. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure). Expected to have a low order of acute dermal toxicity based on component toxicity information. Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

May be irritating to the skin. Repeated and/or prolonged contact with skin may cause inflammation, hyperkeratosis, acanthosis and ulceration.

Eyes

May cause moderate to severe eye irritation.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Hearing. Central nervous system. Liver. Kidneys. Cardiac sensitization.

Repeated dose toxicity

Repeated inhalation exposure of rats to m-xylene caused slight changes in liver histopathology and CNS (behavioral) effects at \Rightarrow 100 ppm (0.43 mg/L) but no ototoxicity at 1800 ppm (7.82 mg/L). Oral exposure of rats to m-xylene for 13 weeks produced decreased body weight gains in males at \Rightarrow 200 mg/kg bwt/day and in females at \Rightarrow 800 mg/kg bwt/day; and exposure to 2000 mg/kg bwt/day for 10 days produced increases in liver weights. No ototoxicity was observed in rats exposed orally to m-xylene at 1798 mg/kg bwt/day. The observed liver effects may be adaptive rather than adverse effects.

Reproductive effects

No effect on testicular weight was found in rats exposed by inhalation to 100 ppm (0.43 mg/L) m-xylene for 13 weeks. No damage to reproductive organs was noted in rats exposed by oral gavage to m-xylene at 800 mg/kg bwt/day for 13 weeks.

Developmental Toxicity

May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to m-xylene was reported to produce decreases in fetal weight and a slight decrease in implantations at 700 ppm (3.0 mg/L) in the presence of maternal toxicity (decreased body weight gain and feed consumption, increased relative liver weight). After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to 2580 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity

m-Xylene produced negative results in assays for gene mutation in bacteria, recessive lethal mutations in the fruit fly, and induction of micronuclei in mouse bone marrow after intraperitoneal injection.

Carcinogenicity

Available data for mixed xylenes indicate that m-xylene is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

- *n-Heptane* 142-82-5

Acute toxicity

<u>LC50 (Inh)</u>	rat	103 GM/M3	4 HOURS
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<u>LD50 (Oral)</u>	mouse	5000 MG/KG	
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<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	
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Target Organs

Central nervous system. Lung.

- *p-Xylene* 106-42-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	4740 PPM	4 HOURS
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<u>LC50 (Inh)</u>	mouse	3907 PPM	6 HOURS
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MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

<u>LD50 (Oral)</u>	rat	4,029 MG/KG
<u>LD50 (Skin)</u>	rabbit	(predicted) > 4,350 MG/KG

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations. Exposure to high vapor concentrations may cause effects on hearing.

Ingestion

May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). Possible cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Skin absorption hazard. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure). Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

May be irritating to the skin. Repeated contact with skin may cause cracking and/or fissuring.

Eyes

May cause eye irritation.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Hearing. Central nervous system. Liver. Kidneys. Cardiac sensitization.

Repeated dose toxicity

May be toxic following repeated exposure to high doses. No standard repeated inhalation exposure study is available. However, in limited scope studies, repeated inhalation exposure of rats to p-xylene caused ototoxicity at ≥ 900 ppm (3.91 mg/L) but not at 450 ppm (1.95 mg/L). Repeated inhalation exposures of laboratory animals to other xylene isomers and/or mixed xylenes caused reduced body weight/weight gain at ≥ 1000 ppm (4.35 mg/L), liver and CNS (behavioral) effects at ≥ 100 ppm (0.43 mg/L), and, in rats, ototoxicity at ≥ 250 ppm (1.09 mg/L). No treatment-related effects were seen in rats after oral exposure to p-xylene at 800 mg/kg bwt/day for 13 weeks. Short-term (10-14 days) repeated oral exposure of rats to p-xylene produced increases in liver weights and decreases in body weights and relative thymus weights at 2000 mg/kg bwt/day, and ototoxicity at 899 mg/kg bwt/day (the only concentration tested for ototoxicity). No ototoxicity was observed in guinea pigs exposed to p-xylene at this dose level. Oral exposure of rats to mixed xylenes at 500 mg/kg bwt/day for 103 weeks produced only slightly decreased body weight. Repeated oral exposure of mice to mixed xylenes produced a reduction in body weight in females at 2000 mg/kg bwt/day for 13 weeks, but no treatment-related effects were seen after exposure to 1000 mg/kg bwt/day for 103 weeks. The observed liver effects may be adaptive rather than adverse effects.

Reproductive effects

This substance is not expected to be a reproductive toxicant. No damage to reproductive organs was noted in rats exposed by oral gavage to p-xylene at 800 mg/kg bwt/day for 13 weeks. Results for mixed xylenes in a one-generation reproductive toxicity study (rats, inhalation at 500 ppm/2.17 mg/L) and two dominant lethal studies (rats, i.p.; mice, s.c; 864 mg/kg bwt), and from evaluation of reproductive organs in repeated dose studies (male rats, inhalation, 1000 ppm [4.35 mg/L]; rats [1000 mg/kg bwt/day] and mice [2000 mg/kg bwt/day], oral) indicate that mixed xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at high inhalation or oral doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to p-xylene was reported to produce decreases in fetal weight and increases in post implantation loss at ≥ 700 ppm 3.0 mg/L), and increases in skeletal variations, but not malformations, at 2000 ppm (8.7 mg/L) in the presence of maternal toxicity (decreased body weight gain



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

and feed consumption, and increased relative liver weight). No effect on neurobehavior was noted in offspring of rat dams exposed to 800 and 1600 ppm (3.5 or 7.0 mg/L) prenatally. After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to p-xylene at ≥ 1935 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity

Not expected to be genotoxic. p-Xylene produced negative results in assays for gene mutation in bacteria and induction of micronuclei in mouse bone marrow after intraperitoneal injection. Two positive responses have been reported for mixed xylenes, but the overall weight of evidence from a variety of in vitro and in vivo genotoxicity studies with xylenes indicates that these substances are not genotoxic.

Carcinogenicity

Available data for mixed xylenes indicate that p-xylene is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

- Benzene 71-43-2

Acute toxicity

<u>LC50 (vapor)</u>	rat	13,700 PPM	4 HOURS
<u>LD50 (Skin)</u>	rabbit	> 8260 MG/KG BWT	

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered body weight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *n-Butane* 106-97-8

Acute toxicity

<u>LC50 (Inhl)</u>	rat	658 MG/L	4 HOURS
	mouse	680 MG/L	2 HOURS

Acute effects

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Irritation

Skin

None expected. Evaporating liquid may cause frost bite.

Eyes

None expected. Evaporating liquid may cause frost bite.

Target Organs

CNS depressant.

Repeated dose toxicity

No biologically significant treatment-related systemic effects were seen when rats were exposed by inhalation for 4-6 weeks to 9000 ppm (21.4 mg/L) nbutane.

Reproductive effects

No signs of reproductive toxicity were observed in an inhalation screening test of rats exposed to up to 9000 ppm (21.39 mg/L) n-butane.

Developmental Toxicity

No signs of developmental toxicity were observed in an inhalation screening test of rats exposed to up to 9000 ppm (21.39 mg/L) n-butane.

12. ECOLOGICAL INFORMATION

Product information

Product Summary

See component summary.

Ecotoxicity

See component summary.

Environmental fate and pathways

COMPONENT INFORMATION



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

- *Naphtha,petroleum, solvent-refined light 64741-84-0*

Ecotoxicity

Toxic to aquatic life with long lasting effects.

Acute Fish toxicity

LL50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 10 mg/l

LL50 / 96 HOURS *Pimephales promelas* (fathead minnow) 8.2 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS waterflea (*daphnia magna*). 4.5 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS *Pseudokirchneriella subcapita* (formerly *Selenastrum capricornutum*)

NOELR / 72 HOURS *Pseudokirchneriella subcapita* (formerly *Selenastrum capricornutum*)

Toxicity to microorganisms

LL50 / 72 HOURS *Tetrahymena pyriformis* (ciliated protozoa) 15.41 mg/l

Chronic toxicity to fish

NOELR / 14 d *daphnia* 2.6 mg/l

Summary: QSAR (Quantitative structure-activity relationship) based calculation predicts low chronic toxicity.

Chronic toxicity to aquatic invertebrates

NOELR / 21 d waterflea (*daphnia magna*). 2.6 mg/l

Summary: QSAR (Quantitative structure-activity relationship) based calculation predicts low chronic toxicity.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Partitioning mainly to air.

Predicted distribution to environmental compartments: The product will be dispersed amongst the various environmental compartments (soil/ water/ air).

- *Hexane Isomers*

Ecotoxicity

Environmental fate and pathways

No data available.

- *Octane Isomers*

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

- *Heptane isomers*

Ecotoxicity

No Data Available.

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. This material is not expected to persist in the environment.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: This material is expected to have slight mobility in soil.

Bioaccumulation: This material may bioaccumulate.

- *n-Hexane 110-54-3*

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.14 mg/l

LC50 / 96 HOUR *Pimephales promelas* 2.5 mg/l

LC50 / 96 HOURS *Lepomis macrochirus* 4.12 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *waterflea*. 3.87 mg/l

Environmental fate and pathways

Photolysis, hydrolysis or bioconcentration of n-hexane are not expected to be an important environmental fate processes. Biodegradation of n-hexane may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A Koc range of 1250 to 4100 indicates a low to slight mobility class in soil for n-hexane. In aquatic systems n-hexane may partition from the water column to organic matter contained in sediments and suspended materials. Rapid volatilization from environmental waters is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Methylcyclopentane 96-37-7*

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

No Data Available.

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Volatilization from dry soil surfaces is expected. Volatilization from moist soil surfaces is expected. The estimated BCF value suggests that this material will bioconcentrate in aquatic organisms.

Persistence and degradability

Stability in soil: This material is expected to have slight mobility in soil.

Biodegradation: No relevant studies identified.

Bioaccumulation: Bioconcentration factor (BCF) ~ 2.5 (estimated) Estimated BCF = 2.5

- *Cyclohexane* 110-82-7

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Pimephales promelas* 4.53 mg/l (flow-through)

LC50 / 96 HOURS *Lepomis macrochirus* 34.72 mg/l

LC50 / 96 HOURS *Poecilia reticulata* 48.0 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 400 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Scenedesmus subspicatus* > 500 mg/l

Toxicity to microorganisms

EC50 / 5 min *Photobacterium phosphoreum* 85.5 mg/l

EC50 / 10 min *Photobacterium phosphoreum* 93 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. It is expected to be poorly adsorbed onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: The potential for volatilization from dry soil surfaces may exist. Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Biodegradation: This material is expected to be resistant to biodegradation.

Bioaccumulation: This material may bioaccumulate.

- *n-Pentane* 109-66-0

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Acute Fish toxicity

LC50 / 96 HOURS *Oncorhynchus mykiss* 4.3 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 9.7 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

Persistence and degradability

Stability in soil: Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Cyclopentane* 287-92-3

Ecotoxicity

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna*. 10.5 mg/l

Environmental fate and pathways

Hydrolysis is not expected to be an important factor in the environmental fate process for this material. It is not expected to adsorb onto soils or sediments. Limited biodegradation. Expected to have high mobility in soils. This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 55 mg/l

LC50 / 96 HOUR *Carassius auratus* 22.8 mg/l

LC50 / 96 HOUR *Pimephales promelas* 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY *Oncorhynchus sp.* 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY *Daphnia magna*. 1.0 mg/l

NOEC / 7 DAY *Ceriodaphnia dubia* 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Methyl Cyclohexane* 108-87-2

Ecotoxicity

This material may be harmful to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR Golden shiner (*notemigonus crysoleucas*) 72 mg/l

Environmental fate and pathways

No Data Available.

- *Ethyl Benzene* 100-41-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 / 96 HOUR *Menidia menidia* 5.1 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* (green algae) 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* (green algae) 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY Ceriodaphnia dubia 3.3 mg/l

NOEL (reproduction) / 7 DAY Ceriodaphnia dubia 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *o*-Xylene 95-47-6

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 7.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS Daphnia magna (Water flea) 1 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Selenastrum capricornutum (green algae) 4.7 mg/l

Toxicity to microorganisms

EC50 / 0.5 HOURS Activated sludge 70 mg/l

Chronic toxicity to fish

NOEC / 56 d Oncorhynchus mykiss (rainbow trout) 1.3 mg/l

Summary: (predicted; mixed xylenes)

Chronic toxicity to aquatic invertebrates

NOEC / 7 d Ceriodaphnia (water flea) 1.17 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Some volatilization from water or soil surfaces is expected, with *o*-xylene initially partitioned mainly to soil and water. Expected to exist solely as a vapor in the ambient atmosphere.

Persistence and degradability

Biodegradation: Inherently biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Bioaccumulation: Significant bioaccumulation is not expected.

- *m-Xylene* 108-38-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 8.4 mg/l

Acute toxicity to aquatic invertebrates

LC50 / 48 HOURS *Daphnia magna* (Water flea) 4.7 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Selenastrum capricornutum* (green algae) 4.9 mg/l

Chronic toxicity to fish

NOEC / 56 d *Oncorhynchus mykiss* (rainbow trout) 1.3 mg/l

Summary: (predicted; mixed xylenes)

Chronic toxicity to aquatic invertebrates

NOEC / 7 d *Ceriodaphnia* (water flea) 1.17 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Readily biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.

Bioaccumulation: Significant bioaccumulation is not expected.

- *n-Heptane* 142-82-5

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 24 HOUR goldfish 4 mg/l

LC50 / 96 HOURS Cichlid fish 375 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS *Daphnia magna*. > 10 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: This material is expected to have slight mobility in soil.

Biodegradation: No data available.

Bioaccumulation: This material may bioaccumulate.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

- *p-Xylene* 106-42-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 2.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS *Daphnia magna* (Water flea) 3.6 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Selenastrum capricornutum* (green algae) 4.4 mg/l

Toxicity to microorganisms

NOEC / 3 HOURS Activated sludge 157 mg/l

Chronic toxicity to fish

NOEC / 56 d *Oncorhynchus mykiss* (rainbow trout) 1.3 mg/l

Summary: (predicted; mixed xylenes)

Chronic toxicity to aquatic invertebrates

NOEC (reproduction) / 21 d *Daphnia magna* (Water flea) 1.57 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Some volatilization from water or soil is expected, with p-xylene initially partitioned mainly to soil and water

Persistence and degradability

Biodegradation: This material is expected to be readily biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.

Bioaccumulation: Significant bioaccumulation is not expected. Fish BCF (*Anguilla japonica*) 23.6 after 10 days (mixed xylenes); BCF (*Carassius auratus*) 14.8 (xylene isomer).

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna*. 10 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 32 mg/l

Toxicity to microorganisms

IC50 / 24 HOURS *Nitrosomonas* sp. 13 mg/l

Chronic toxicity to fish

LOEC / 32 DAY *Pimephales promelas* 1.6 mg/l

Chronic toxicity to aquatic invertebrates

NOEC / 7 DAY *Ceriodaphnia dubia* 3 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *n-Butane* 106-97-8

Ecotoxicity

This material is expected to be non-hazardous to aquatic species.

Environmental fate and pathways

This material is likely to evaporate from soil and water.

Persistence and degradability

Stability in water: Not likely to adsorb to suspended solids and sediment in water.

Stability in soil: Expected to have very high to moderate mobility in soils. Volatilization from surface soil may be quite rapid, although this process may be slowed by dicyclopentadiene's adsorption to the soil. This compound is expected to display low mobility. Biodegradation and hydrolysis are not expected to be significant factors.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

Contaminated product, soil, water, and empty containers may be hazardous wastes due to possible presence of flammable gases. Assure emissions comply with applicable regulations. Preferred disposal for this volatile, flammable product is through combustion. Use flare if pressure warrants. Proper grounding procedures to avoid static electricity should be followed. The product should not be allowed to enter drains, water courses or the soil.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Petroleum distillates, n.o.s. (HEPTANES, HEXANES)

Reportable quantity BENZENE
TOLUENE

ID No. UN1268

Hazard class 3

Packing group II



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
n-Hexane		5000 lbs
Cyclohexane		1000 lbs
Toluene		1000 lbs
Ethyl Benzene		1000 lbs
Benzene		10 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
n-Hexane	1.0%
Cyclohexane	1.0%
Toluene	1.0%
Ethyl Benzene	0.1%
Benzene	0.1%

State Reporting

Known to the State of California to cause cancer.

100-41-4 Ethyl Benzene (December 11, 2009)
 71-43-2 Benzene

Known to the State of California to cause birth defects.

108-88-3 Toluene (December 11, 2009)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE89
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 12/12/2011

BT RAFFINATE

71-43-2 Benzene

Known to the State of California to cause reproductive toxicity in males.

71-43-2 Benzene

(December 11, 2009)

Known to the State of California to cause reproductive toxicity in females.

108-88-3 Toluene

(December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

110-54-3 n-Hexane
 96-37-7 Methylcyclopentane
 110-82-7 Cyclohexane
 108-88-3 Toluene
 109-66-0 n-Pentane
 100-41-4 Ethyl Benzene
 287-92-3 Cyclopentane
 108-87-2 Methyl Cyclohexane
 142-82-5 n-Heptane
 71-43-2 Benzene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

110-54-3 n-Hexane
 96-37-7 Methylcyclopentane
 110-82-7 Cyclohexane
 108-88-3 Toluene
 109-66-0 n-Pentane
 100-41-4 Ethyl Benzene
 287-92-3 Cyclopentane
 108-87-2 Methyl Cyclohexane
 142-82-5 n-Heptane
 71-43-2 Benzene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

110-54-3 n-Hexane
 96-37-7 Methylcyclopentane
 110-82-7 Cyclohexane
 108-88-3 Toluene
 109-66-0 n-Pentane
 100-41-4 Ethyl Benzene
 287-92-3 Cyclopentane
 108-87-2 Methyl Cyclohexane
 142-82-5 n-Heptane
 71-43-2 Benzene

Labeling

Other

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE89
Variant: U.S.A.-EN
Revision: 1.0
Validation Date: 12/12/2011

BT RAFFINATE**Other**

No additional information available.

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. November 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

AP0185
 HFR# 34,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: FLUID GASOLINE LIGHT

Number: 00000000000016079

Chemical characterization: Mixture

CAS-No.: 64741-55-5

Synonyms: Light Catalytic Cracked Naphtha(Petroleum), Light Naphtha from a Fluid Catalytic Cracker Unit(FCCU), FCCU Light Naphtha or Gasoline, Gasoline Blending Component, C4-C9 Solvent or Naphtha, C4-C9 Petroleum Hydrocarbons

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

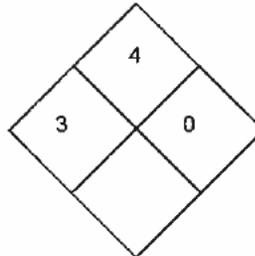
Signal Word

DANGER.

Hazards

Extremely flammable. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. Vapor may cause flash fire or explosion. Poison. Harmful or fatal if swallowed. May cause central nervous system effects. Contains hydrogen sulfide gas, maybe fatal if inhaled. May cause lung damage. Possible cancer hazard. Harmful to aquatic organisms.

NFPA®



HMIS®

Health	*	3
Flammability		4
Physical Hazard		0

Physical state

liquid

Color

Clear pale yellow to amber.

Odor

Hydrogen sulfide; rotten eggs.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Odor Threshold
 No Data Available.

Potential health effects

Routes of exposure
 Skin. Inhalation. Ingestion.

Acute effects
 Inhalation hazard. May cause drowsiness and dizziness. See component summary.

- *Hexane isomers*

May be irritating to the eyes, skin, and respiratory system. Inhalation of vapors may cause dizziness, narcosis, nausea or asphyxiation. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *n-Hexane 110-54-3*

May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. May be irritating to the skin. High or repeated exposures can damage the peripheral nervous system, causing numbness, tingling, and/or muscle weakness in the hands or feet. The onset of health effects associated with n-hexane may be influenced by exposure to additional chemicals such as methyl isobutyl ketone and methyl ethyl ketone.

- *Xylene 1330-20-7*

May be irritating to the eyes, skin, and respiratory system. Aspiration hazard. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Butenes 25167-67-3*

CNS depressant. Simple asphyxiant. Contact with liquid may cause frostbite.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Cyclohexane 110-82-7*

CNS depressant. Simple asphyxiant. May be irritating to the eyes, skin, and respiratory system.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Trimethylbenzene 25551-13-7*

CNS depressant. Aspiration hazard.

- *Ethyl Toluene 25550-14-5*

May be irritating to the skin.

- *1,3-Butadiene 106-99-0*

May be irritating to the eyes, skin, and respiratory system. CNS depressant.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *Hydrogen sulfide 7783-06-4*

Hydrogen sulfide is a highly toxic gas that can be fatal in certain concentrations. Skin absorption hazard. Respiratory tract irritant. Inhalation may cause asthma-like symptoms, including coughing, wheezing, tightness of chest, shortness of breath, and headache. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), with severe shortness of breath. CNS depressant.

Skin

May produce skin irritation. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis. May cause irritation to the skin. This irritation can result in redness and swelling of the skin. Repeated contact with the skin may cause it to become dry and cracked. May be absorbed through the skin and produce toxic effects such as CNS depression.

Inhalation

Can cause pulmonary edema if aspirated into lungs. May produce symptoms of central nervous system depression including headache, dizziness, nausea, euphoria, loss of equilibrium, drowsiness, visual disturbances, fatigue,



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Inhalation

unconsciousness and respiratory arrest. High concentrations of this substance may cause cardiac arrhythmias that may be fatal. Hydrogen sulfide is a highly toxic gas that can be fatal in certain concentrations. Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression.

Eyes

May cause moderate irritation, including burning sensation, tearing, redness or swelling. Effects of eye irritation are reversible. May cause moderate irritation, including burning sensation, tearing, redness or swelling. May cause blurred vision. Effects may become more severe with repeated or prolonged contact.

Ingestion

Aspiration may cause lung damage. Harmful if swallowed. May cause abdominal discomfort, nausea and diarrhea. Aspiration into the lungs during swallowing or vomiting can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section.

Chronic effects

Prolonged contact with the skin may cause mechanical irritation and subsequent dermatitis. Prolonged or repeated exposure to vapors may cause lung damage. Contains material which may cause cancer based on animal data. Contains material that may cause adverse reproductive effects. Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung tumor) formation and chronic lung dysfunction. Altered mental states, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "petrol sniffers encephalopathy"), delirium, seizures, and sudden death have been common symptoms among gasoline and naphtha abusers. Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Animal carcinogen. These findings are not likely relevant to humans. See chapter 11. Toxicological information

- *Hexane isomers*

Eye irritation, skin irritation leading to dermatitis, chemical pneumonia, and central nervous system depression may occur from repeated or prolonged exposure.

- *n-Hexane 110-54-3*

Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Prolonged and repeated exposure to vapors may cause damage to the CNS, lungs and kidneys. Suspect reproductive hazard.

- *Xylene 1330-20-7*

May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard.

- *Butenes 25167-67-3*

Hazard identification for this product is based on information available on its components.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Cyclohexane 110-82-7*

No adverse chronic human health effects have been reported for this material.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Trimethyl benzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *Ethyl Toluene 25550-14-5*

Specific data not available.

- *1,3-Butadiene 106-99-0*

Known human carcinogen. Reproductive and developmental effects were present in test animals.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *Hydrogen sulfide 7783-06-4*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated exposure may cause eye damage with possible loss of vision.

Aggravated Medical Condition

Any pre-existing disorders or diseases of the: central nervous system (CNS) peripheral nervous system or heart Any pre-existing disorders or diseases of the: central nervous system (CNS) peripheral nervous system or heart

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Hexane isomers	Mixture	Mixture	5.0 <= 15.0
n-Hexane	110-54-3	203-777-6	1.0 <= 10.0
Xylene	1330-20-7	215-535-7	1.0 <= 5.0
Butenes	25167-67-3	246-689-3	1.0 <= 5.0
Benzene	71-43-2	200-753-7	1.0 <= 5.0
Cyclohexane	110-82-7	203-806-2	1.0 <= 5.0
Toluene	108-88-3	203-625-9	1.0 <= 5.0
Trimethyl benzene	25551-13-7	247-099-9	0.5 <= 1.5
Ethyl Toluene	25550-14-5	247-093-6	0.5 <= 1.5
1,3-Butadiene	106-99-0	203-450-8	< 1.0
Ethyl Benzene	100-41-4	202-849-4	0.2 <= 1.0
Hydrogen sulfide	7783-06-4	231-977-3	< 0.2

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Remove contaminated clothing as needed. Flush skin with water. Do not use ointments. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Inhalation

Immediately remove victim to fresh air. If victim has stopped breathing, give artificial respiration, preferably mouth-to-mouth. GET MEDICAL ATTENTION IMMEDIATELY. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, give oxygen.

Eyes

Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold the eyes apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Never give anything by mouth to an unconscious person.

Notes to physician

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

< -45 °C (-49 °F) closed cup

Autoignition temperature

No Data Available.

Lower explosion limit

~ 1 vol%

Upper explosion limit

~ 7 vol%

Extinguishing Media

Suitable extinguishing media

LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams. SMALL FIRE: Use drychemicals, CO₂, or foam. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear.

Precautions for fire-fighting

Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Notify authorities immediately if liquid enters sewer/public waters. Assure good ventilation to prevent flammable vapor formation. This material releases flammable vapors at well below ambient temperatures and may form flammable mixtures with air. When mixed with air in certain proportions and exposed to an ignition source, these vapors can burn in the open or be explosive in



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Precautions for fire-fighting

confined spaces. Being heavier than air, these vapors may travel long distances along the ground before reaching a point of ignition and flashing back. Heat may build enough pressure to rupture dosed containers/spreading fire/increasing risk of burns/injuries.

Hazardous combustion products

Carbon Monoxide. Carbon dioxide. Oxides of nitrogen. Oxides of sulfur.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Flammable liquid. Release causes immediate fire/explosion hazard. A vapor suppressing foam may be used to reduce vapors. Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Stop leak if you can do it without risk. Do not touch or walk through spilled material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Contain spill with dike to prevent entry into sewers or waterways. Depending on the size and nature of the release, all responders may need to be HAZWOPER trained and local, state and federal authorities may need to be notified. Use suitable disposal containers. Contain spill and evacuate all non-essential personnel. In urban areas, cleanup spill as soon as possible; in natural environments, seek cleanup advice from environmental specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. This material will float on water and its run-off may create an explosion or fire hazard. Comply with all laws and regulations.

7. HANDLING AND STORAGE

Handling

Store in tightly closed containers. Eliminate every possible source of ignition. Equipment containing this material should be isolated and thoroughly drained, washed and purged prior to maintenance/repair operations. Electrostatic charges may be generated as a result of flow or agitation. Handle empty containers with care - residue may be combustible and burn if exposed to heat/sparks/open flame. A spill or leak can cause an immediate fire/explosion hazard. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. A static spark or discharge can ignite accumulated vapors, particularly during dry weather conditions. Product container is not designed for elevated pressure. Bond and ground all equipment before transferring this material from one container to another. Never siphon by mouth. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material. After handling, always wash hands thoroughly with soap and water. Always keep nozzle in contact with the container throughout the loading process. Do not pressurize or expose empty containers to open flame, sparks, or heat. Do not fill any portable container in or on a vehicle without proper bonding. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance.

Storage

Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room. All equipment must conform to applicable electrical code. Store and transport in accordance with all applicable laws.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If mechanical ventilation is used, electrical systems should conform to U.S. National Electric Code. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1) Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If mechanical ventilation is used, electrical systems should conform to U.S. National Electric Code. Emergency shower and



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Engineering Controls

eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

A respiratory protection program which complies with U.S. Occupational Safety and Health Administration (OSHA) general industry standard 1910.134(e) should be implemented. A full-faced supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

Skin

Avoid contact with skin. Skin should be washed after contact. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners. Use heavy duty gloves constructed of chemical resistant materials such as Viton® or heavy nitrile rubber. Avoid contact with skin. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Promptly remove and discard contaminated leather goods (gloves, belts, shoes, wallets, etc). Upon clothing contamination, immediately remove soaked clothing and shower. Wear long-sleeved fire-retardant garments (e.g., Nomex (R)) while working with flammable and combustible liquids.

Eyes

Wear safety glasses. Where the opportunity for a splash or spray caused by high pressure or agitation of the material is possible, use a face shield and chemical goggles. Suitable eye wash water should be readily available.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Odor is an inadequate warning for hazardous conditions. Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing.

Occupational Exposure Limits

Consult local authorities for acceptable exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Clear pale yellow to amber.

Odor: Hydrogen sulfide; rotten eggs.

Odor Threshold: No Data Available.

pH: Not applicable.

Boiling point/boiling range: ≥ 69 °C (156.2 °F)

Melting/freezing point: No Data Available.

Flash point: < -45 °C (-49 °F) closed cup

Autoignition temperature: No Data Available.

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: ~ 1 vol%



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Upper explosion limit: ~ 7 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: <= 16.5 kPa @ 20 °C (68 °F)

Evaporation rate: No Data Available.

Relative density: 0.8661(Water = 1)

Relative vapor density: > 1 (Air = 1.0)

Viscosity: No Data Available.

Water solubility: Very slightly soluble in cold water.

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks and open flame.

Materials to avoid

Strong acids. Strong bases. Strong oxidizer.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Inhalation of high vapor concentrations can cause CNS-depression and narcosis. Inhalation of vapors in high concentration may cause shortness of breath (lung edema). Solvents may degrease the skin. Prolonged exposure may produce anesthetic and narcotic effects. (See Component Toxicity Information).

Acute toxicity

<u>LC50 (Inh)</u>	rat	>5.61	4 HOURS
<u>LD50 (Oral)</u>	rat	>5,000 MG/KG	
<u>LD50 (Skin)</u>	rabbit	>2000 MG/KG	

Acute effects

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Inhalation may cause CNS depression. Can cause pulmonary edema if aspirated into lungs.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Skin irritant. Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Eyes

Non-irritating to the eyes. Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Blood. Liver. Kidneys. Lung. Central nervous system.

Reproductive effects

Stream expected not to be toxic to reproduction based on toxicity information for streams having components in common with this stream.

Developmental Toxicity

Suspected of damaging the unborn child. Stream expected to be toxic to development based on toxicity information for components present in this stream.

Genetic Toxicity

Mutagenic Substance. May cause genetic defects. Stream expected to be mutagenic based on toxicity information for components present in this stream.

Carcinogenicity

May cause cancer. Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream.

COMPONENT INFORMATION

- *Hexane isomers*

Acute effects

Inhalation

Overexposure may cause irritation to the respiratory tract and to other mucous membranes. May produce symptoms of central nervous system depression including headache, dizziness, nausea, loss of sense of balance, drowsiness, visual



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

disturbances, unconsciousness and sense of balance, drowsiness, visual disturbances, unconsciousness and death.

Irritation

Skin

May be irritating to the skin.

Eyes

May cause eye irritation.

Target Organs

Skin. Eye. Respiratory system. CNS depressant.

Repeated dose toxicity

No known chronic health effects.

Reproductive effects

Not expected to occur.

Developmental Toxicity

Not expected to occur.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Hexane* 110-54-3

Acute toxicity

LC50 (Inhl) rat 48,000 PPM 4 HOURS

LD50 (Oral) rat 28,710 MG/KG

LD50 (Skin) rabbit 3000 MG/KG

Irritation

Eyes

Eye irritant.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Peripheral nervous system Testes.

Repeated dose toxicity

Rabbits exposed by inhalation to 3,000 ppm 8 hours/day for 8 days showed changes in the lungs, emphysema, necrosis of the bronchial epithelium, and atelectasis. Rats continuously exposed to 400 ppm developed anoxapathy, although intermittent exposure to 10,000 ppm 6 hours/day, 5 days/week for 13 weeks caused only mild paranodal axonal swelling. The offspring of rats and mice exposed orally or by inhalation to n-hexane during gestation showed depressed weight gain after birth. This agent also affects male and female reproductive capacity.

Reproductive effects

Exposure to n-hexane may damage the developing fetus.

Developmental Toxicity

Causes productive and embryotoxic effects and is cytotoxic in mammalian and human test systems.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

Exposure of humans to 5,000 ppm n-hexane for 10 minutes causes marked vertigo; exposure to 1,500 ppm results in headache and slight nausea. In industrial settings, exposure to levels exceeding 1,000 ppm have been reported to cause mild symptoms of narcosis. Eye and upper respiratory tract irritation has been reported to occur in humans exposed to 880 ppm n-hexane for 15 minutes. Dermal contact with n-hexane results in immediate irritation characterized by erythema and hyperemia; exposed subjects developed blisters 5 hours following dermal exposure to n-hexane. The neuropathic toxicity of n-hexane in humans is well documented; cases of polyneuropathy have typically occurred in humans chronically exposed to levels of n-hexane ranging from 400 to 600 ppm, with occasional exposures up to 2,500 ppm. Distal symmetrical motor weakness is common in most cases; however, in severely affected individuals, motor weakness may



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Other information

extend to the pelvic and high musculature. Nerve biopsies in affected individuals show swelling of the nerve and thinning of the myelin sheath. Functional neurological disturbances usually progress for a few months after termination of exposure. Although recovery is expected to occur within a year, clinical polyneuropathy has been reported in some cases to remain after 2 years. Blurred vision, restricted visual field, and optic nerve atrophy has been reported to occur in association with n-hexane-induced polyneuropathy.

- *Xylene* 1330-20-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	5000 PPM	4 HOURS
	mouse	3907 MG/KG	6 HOURS
	rat	4550 PPM	4 HOURS

LD50 (Oral) rat 4300 MG/KG

LD50 (Skin) rabbit >1700 MG/KG

Irritation

Skin

Moderate skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

This material is expected to be a mild eye irritant. Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Target Organs

Skin. Eye. central nervous system (CNS)

Repeated dose toxicity

Repeated inhalation exposures of rats to xylenes cause liver effects at 920 ppm (4.0 mg/L) and ototoxicity at \geq 800 ppm (3.48 mg/L). Repeated oral exposures to xylenes produce reductions in body weight in male rats at 500 mg/kg bwt/day; liver effects and hyaline droplet formation in male rats at \geq 150 mg/kg bwt/day; kidney effects in male and female rats at \geq 750 mg/kg bwt/day, and a reduction in bodyweight gain in male mice at \geq 250 mg/kg bwt/day. Repeated inhalation exposures of gerbils to \geq 160 ppm (0.70 mg/L) xylenes cause apparently irreversible CNS effects.

Reproductive effects

A reproductive toxicity study, two dominant lethal studies, and evaluation of reproductive organs in repeated dose studies indicate that xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at non-anesthetic doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

Results from animal studies demonstrate that xylenes may cause reduced fetal weight and delayed ossification, but not malformations, at inhalation dose levels causing no or only slight maternal toxicity (\geq 115 ppm or 0.5 mg/L). Slight neurobehavioral effects were noted in offspring of rats exposed to 500 ppm (2.2 mg/L) in the absence of maternal toxicity.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Butenes* 25167-67-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	> 23 MG/L	4.0 HOURS
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Acute effects

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Irritation

Skin

No data on skin irritation found. Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

Eyes

There is no evidence to suggest this material may cause eye irritation.

Sensitization

No evidence of skin or respiratory sensitization.

Target Organs

Nasal cavity.

Repeated dose toxicity

Based on available animal data for components and for a stream having components in common with this stream minimal toxic effects from repeated exposures are expected. A Crude Butadiene C4 olefin stream administered by inhalation to rats at 20 mg/L for 4 wks produced no biologically significant treatment-related systemic effects. The stream components tested for repeated exposure toxicity include isobutylene, 2-butene, and 1-butene and their reported toxicological effects include: decreased body weight and nasal lesions. (See component information for details). No known chronic health effects.

Developmental Toxicity

Based on available animal data for components and a stream having components in common with this stream, this stream is not expected to cause developmental toxicity or teratogenicity. No developmental toxicity or teratogenicity was observed in screening studies conducted in rats exposed to a Crude Butadiene C4 olefin stream containing mostly butenes at 20 mg/L or to high concentrations of the components, isobutylene, 1-butene, or 2-butene. (See component information for details).

Carcinogenicity

This stream contains carcinogenic components. Cancer data for butadiene are used as surrogate data for this stream, which contain up to 0.5% butadiene. The stream component, isobutylene, produced tumors in long term animal studies. (See component information for details).

- Benzene 71-43-2

Acute toxicity

rat	13,700 PPM	4 HOURS
rabbit	> 8260 MG/KG BWT	

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered bodyweight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Cyclohexane 110-82-7*

Acute toxicity

<u>LC50 (Inhl)</u>	rat	13.9 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	> 5000 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 2000 MG/KG	

Target Organs

Central nervous system effects.

Repeated dose toxicity

No known chronic health effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Toluene 108-88-3*

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *Trimethyl benzene* 25551-13-7

Acute toxicity

LD50 (Oral) rat 8970 MG/KG

Irritation

Skin

Skin irritant.

- *Ethyl Toluene* 25550-14-5

Acute toxicity

<u>LC50 (Inhl)</u>	50	2 HOURS
mouse	54	4 HOURS

Irritation

Skin

Skin irritant.

Repeated dose toxicity

Repeated exposure may cause liver and kidney damage.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

- 1,3-Butadiene 106-99-0

Acute toxicity

<u>LC50 (Inhl)</u>	rat	285 MG/L	4 HOURS
	mouse	267 MG/L	4 HOURS

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

There are no known reliable studies regarding toxicity in humans or animals after oral exposures.

Skin contact

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures. There are no known reliable studies regarding sensitization in test animals. However, human experience suggests that it is unlikely to cause allergic skin conditions.

Irritation

Skin

Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite. There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures. There are no known reliable studies regarding sensitization in test animals. However, human experience suggests that it is unlikely to cause allergic skin conditions.

Eyes

Vapor may be irritating to the eye, especially at high concentrations.

Target Organs

Respiratory system. Lymphohematopoietic system. Gonads. Liver. Damages the heart. Central nervous system.

Repeated dose toxicity

Butadiene is highly toxic in the mouse, producing lesions in a range of tissues (including ovary, testis, lung, liver, bone marrow, thymus, forestomach and heart) after repeated inhalation exposure. No comparable changes occurred in rats or other laboratory animal species, hence the relevance of these findings to humans is that it is a known carcinogen.

Reproductive effects

Testicular- and ovarian atrophy, and changes in sperm head morphology, have been reported in mice following repeated exposure to butadiene vapor, however no adverse effects on fertility or reproduction have been reported.

Developmental Toxicity

Results from animal studies demonstrate that butadiene is not a teratogen, however mild fetotoxicity (primarily retarded development) has been observed in rodents exposed to high levels of butadiene vapor during pregnancy. These effects generally occur at exposures that also produce maternal toxicity.

Genetic Toxicity

Butadiene is genotoxic in the mouse, and induces micronuclei, chromosomal aberrations and gene mutations after inhalation exposure. Most studies with rats are negative; however, butadiene produced hprt mutations in rats, but at a concentration much higher than that required for mice. Studies to assess genetic damage in exposed worker populations have returned inconsistent or equivocal results.

Carcinogenicity

Animal data demonstrate marked species difference in carcinogenic response to butadiene. In the mouse, long term inhalation exposure is associated with an increased incidence of benign and malignant cancers in a wide range of tissues, whereas a more limited tumor profile is seen in the rat. Epidemiology studies suggest butadiene may be carcinogenic in humans with a concern for cancers of the lymphohematopoietic system. Listed by IARC as "carcinogenic to humans" (Group 1), on the basis of "sufficient evidence" in humans of an increased risk for leukemias. Listed by NTP as known to be a human carcinogen in their Report on Carcinogens, current edition. This listing was based on sufficient evidence of carcinogenicity in humans, including epidemiologic and mechanistic information, to indicate a causal relationship between occupational exposure to 1,3-butadiene and excess mortality from lymphatic and hematopoietic cancers.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

- Ethyl Benzene 100-41-4

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of ≥ 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bw/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *Hydrogen sulfide* 7783-06-4

Acute toxicity

LC50 (Inhl) rat 0.701 MG/L 4 HOURS

Acute effects

Inhalation

Inhalation may cause CNS depression. Damages the respiratory system.

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Irritation

Eyes

Eye irritant.

Target Organs

Eye. Lung. Central nervous system effects. Nasal cavity. Respiratory system. Heart

Repeated dose toxicity

Repeated inhalation exposure of rats and mice to hydrogen sulfide for 90 days produced decreases in body weight gain and feed consumption at 80 ppm (0.11 mg/L), lesions in the nasal tract and (in rats) lung at >_ 30 ppm (0.04mg/L). Nasal lesions were also observed when rats were exposed to >_ 30 ppm for 10 weeks or >_ 80 ppm for 5 days. Decreased performance in neurological tests has been observed in rats exposed by inhalation to >_ 80 ppm hydrogen sulfide for 5 days; however, no neuropathologic findings were noted when rats and mice were exposed to 80 ppm for 90 days. Rabbits exposed half an hour per day for 5 days to 72 ppm (0.10 mg/L) experienced cardiac arrhythmia.

Reproductive effects

No significant alterations in reproductive performance were observed in rats exposed to 80 ppm (0.111 mg/L) hydrogen sulfide in an inhalation screening study. No treatment-related histopathological changes were found in reproductive organs of rats or mice exposed to up to 80 ppm for 90 days. No adverse effect on spermatogenesis was found when male rats were exposed to 220 ppm (0.306 mg/L) for 7 days, then mated with unexposed virgin females.

Developmental Toxicity

No signs of developmental toxicity, including effects on neurobehavioral performance, were seen in a well-conducted rat inhalation reproduction/developmental toxicity screening study at up to 80 ppm (0.111 mg/L); and no evidence of developmental toxicity was seen in three other studies in which rats were exposed to hydrogen sulfide during gestation at concentrations up to 220 ppm (0.306 mg/L). However, neuro-developmental toxicity studies with offspring of rats exposed to hydrogen sulfide during the gestation and lactation periods have found some alterations that are suggestive of neurotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

(e.g., alterations in cerebellar Purkinje cell growth and developmental neurochemical effects) after exposure to 20 ppm (0.028 mg/L). The toxicological significance of these findings in the absence of alterations in neurobehavioral performance is not known.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Toxic to aquatic life with long lasting effects. See component summary.

Acute Fish toxicity

LL50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 10 mg/l

LL50 / 96 HOURS *Pimephales promelas* (fathead minnow) 8.2 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS *Daphnia magna* (Water flea) 4.5 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 3.1 mg/l

NOELR / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 0.5 mg/l

Toxicity to microorganisms

EC50 / 40 HOURS *Tetrahymena pyriformis* (ciliated protozoa) 15.41 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOELR / 14 d fish 2.6 mg/l

Summary: QSAR (Quantitative structure-activity relationship) based calculation predicts low chronic toxicity.

Chronic toxicity to aquatic invertebrates

NOELR / 21 d *Daphnia magna* (Water flea) 2.6 mg/l

Environmental fate and pathways

If released to water it will float. This material is likely to evaporate from soil and water.

COMPONENT INFORMATION

- *Hexane isomers*

Ecotoxicity

No Data Available.

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Persistence and degradability

Bioaccumulation: Not expected to occur.

- *n-Hexane* 110-54-3

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.14 mg/l

LC50 / 96 HOUR *Pimephales promelas* 2.5 mg/l

LC50 / 96 HOURS *Lepomis macrochirus* 4.12 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 3.87 mg/l

Environmental fate and pathways

Photolysis, hydrolysis or bioconcentration of n-hexane are not expected to be an important environmental fate processes. Biodegradation of n-hexane may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A K_{oc} range of 1250 to 4100 indicates a low to slight mobility class in soil for n-hexane. In aquatic systems n-hexane may partition from the water column to organic matter contained in sediments and suspended materials. Rapid volatilization from environmental waters is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Xylene* 1330-20-7

Ecotoxicity

This material is classified as harmful to fish.

Acute Fish toxicity

LC50 / 96 HOUR rainbow trout. 13.5 mg/l

LC50 / 24 HOUR goldfish 13 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Expected to have moderate mobility in soils. Volatilization from moist soil surfaces is expected. Volatilization from dry soil surfaces is expected.

Persistence and degradability

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

- *Butenes* 25167-67-3

Ecotoxicity

When released into the environment, this material will volatilize rapidly.

Acute Fish toxicity

LC50 / 96 HOURS fathead minnow

Summary: 6.28 – 40.98 mg/l calculated range. This material is harmful to fish. Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

Acute toxicity to aquatic invertebrates

LC50 / 48 HOURS Daphnia magna.

Summary: 7.15 – 43.88 mg/l calculated range. This material is harmful to aquatic invertebrates. Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

Toxicity to aquatic plants

EC50 / 72 HOURS algae

Summary: 4.71 – 27.42 mg/l calculated range. This material is harmful to algae or higher aquatic plants. Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

Summary: No Data Available.

Environmental fate and pathways

The atmosphere is the main environmental compartment for released stream chemicals where they will react rapidly with hydroxyl radicals (half-life 2 - 53 hrs). In water, volatilization will result in substantial losses to the atmosphere.
 No Data Available.

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

/96 HOURS Oncorhynchus mykiss (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

/48 HOURS Daphnia magna. 10 mg/l

Toxicity to aquatic plants

/72 HOURS Pseudokirchneriella subcapitata (green algae) 32 mg/l

Toxicity to microorganisms

/24 HOURS Nitrosomonas sp. 13 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Chronic toxicity to fish

/ 32 DAY Pimephales promelas 1.6 mg/l

Chronic toxicity to aquatic invertebrates

/ 7 DAY Ceriodaphnia dubia 3 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for bioaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Cyclohexane* 110-82-7

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Pimephales promelas 4.53 mg/l (flow-through)

LC50 / 96 HOURS Lepomis macrochirus 34.72 mg/l

LC50 / 96 HOURS Poecilia reticulata 48.0 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 400 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Scenedesmus subspicatus > 500 mg/l

Toxicity to microorganisms

EC50 / 5 min Photobacterium phosphoreum 85.5 mg/l

EC50 / 10 min Photobacterium phosphoreum 93 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. It is expected to be poorly adsorbed onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: The potential for volatilization from dry soil surfaces may exist. Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Biodegradation: This material is expected to be resistant to biodegradation.

Bioaccumulation: This material may bioaccumulate.

- *Toluene* 108-88-3



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 55 mg/l

LC50 / 96 HOUR *Carassius auratus* 22.8 mg/l

LC50 / 96 HOUR *Pimephales promelas* 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna* 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY *Oncorhynchus* sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY *Daphnia magna* 1.0 mg/l

NOEC / 7 DAY *Ceriodaphnia dubia* 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Ethyl Toluene* 25550-14-5

Ecotoxicity

No data available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Environmental fate and pathways

No data available.

- *1,3-Butadiene* 106-99-0

Ecotoxicity

Due to the physio-chemical characteristics of this material, no reliable test data are available.

Environmental fate and pathways

The atmosphere is the main environmental compartment for released butadiene where it will react rapidly with hydroxyl radicals (half-life 1 - 10 hr) and ozone (half-life 8 - 48 hr). In water, volatilization will result in substantial losses to the atmosphere with a half-life of about 4 hr.

Persistence and degradability

Biodegradation: Not readily biodegradable (but would be lost from open waters by evaporation).

Bioaccumulation: Bioconcentration factor (BCF) 10 - 13 (estimated) Bioaccumulation is unlikely.

- *Ethyl Benzene* 100-41-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 / 96 HOUR *Menidia menidia* 5.1 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY Ceriodaphnia dubia 3.3 mg/l

NOEL (reproduction) / 7 DAY Ceriodaphnia dubia 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Hydrogen sulfide* 7783-06-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Lepomis macrochirus 0.0448 mg/l (flow-through)

LC50 / 96 HOURS Pimephales promelas 0.016 mg/l (flow-through)

Acute toxicity to aquatic invertebrates

EC50 / 96 HOURS Gammarus pseudolimnaeus 0.022 mg/l

Other adverse effects

No Data Available.

Environmental fate and pathways

When released into the environment, this material will volatilize rapidly. This material is not expected to persist in the environment.

Persistence and degradability

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

It is the responsibility for the waste generator to characterize waste streams relative to the pertinent regulatory provisions to ensure that applicable requirements are reviewed and met. Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations. Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. The materials resulting from clean-up operations may be hazardous wastes and therefore, subject to specific regulations. Contact the RCRA/ Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulation (see 40 CFR Parts 260 through 271). State and/or local regulations may be more restrictive.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

14. TRANSPORT INFORMATION

Proper shipping name Petroleum distillates, n.o.s. (HEXANE, XYLENE)
Reportable quantity BENZENE
 BUTADIENE
ID No. UN1268
Hazard class 3
Packing group II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	NDSL
China	IECS
European Union	EINECS
United States of America	TSCA
New Zealand	NZIC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

Component	TPQ	RQ
Hydrogen sulfide	500lbs	100 lbs
Cyclohexane		1000 lbs
1,3-Butadiene		10 lbs
Benzene		10 lbs
Xylene		100 lbs
n-Hexane		5000 lbs
Toluene		1000 lbs
Ethyl Benzene		1000 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Fire Hazard.
 Delayed (Chronic) Health Hazard.
 Immediate (Acute) Health Hazard.

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

Component	Reporting Threshold
Cyclohexane	1.0%
1,3-Butadiene	0.1%
Benzene	0.1%



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

Xylene	1.0%
n-Hexane	1.0%
Toluene	1.0%
Ethyl Benzene	0.1%

State Reporting

Known to the State of California to cause cancer.

106-99-0	1,3-Butadiene	(December 11, 2009)
71-43-2	Benzene	
100-41-4	Ethyl Benzene	

Known to the State of California to cause birth defects.

106-99-0	1,3-Butadiene	(December 11, 2009)
71-43-2	Benzene	
108-88-3	Toluene	

Known to the State of California to cause reproductive toxicity in males.

106-99-0	1,3-Butadiene	(December 11, 2009)
71-43-2	Benzene	

Known to the State of California to cause reproductive toxicity in females.

106-99-0	1,3-Butadiene	(December 11, 2009)
108-88-3	Toluene	

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

25550-14-5	Ethyl Toluene
25167-67-3	Butenes
25551-13-7	Trimethyl benzene
7783-06-4	Hydrogen sulfide
110-82-7	Cyclohexane
106-99-0	1,3-Butadiene
71-43-2	Benzene
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
100-41-4	Ethyl Benzene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

25551-13-7	Trimethyl benzene
7783-06-4	Hydrogen sulfide
110-82-7	Cyclohexane
106-99-0	1,3-Butadiene
71-43-2	Benzene
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
100-41-4	Ethyl Benzene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE159
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE LIGHT

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

25167-67-3	Butenes
25551-13-7	Trimethyl benzene
7783-06-4	Hydrogen sulfide
110-82-7	Cyclohexane
106-99-0	1,3-Butadiene
71-43-2	Benzene
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
100-41-4	Ethyl Benzene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. February 2009

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

AP0187
 HFR# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: FLUID GASOLINE HVY

Number: 000000000000016081

Internal ID: AP0187

CAS-No.: 64741-54-4

Chemical Name: Naphtha, petroleum, heavy catalytic cracked

Synonyms: FCCU Heavy Gasoline or Naphtha; Untreated Cat Cracked Heavy Gasoline; FLuid Unit Gasoline Splitter Tower Bottoms; Catalytic Naptha Fractionator (CNF) Feedstock; 735 Unit CNF; Magnaformer CNFFeedstock; Heavy Catalytic Crackerd Naptha (Petroleum).

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

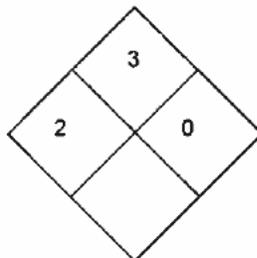
Signal Word

DANGER.

Hazards

Extremely flammable liquid. Heavier than air, vapors may travel long distances along the ground before igniting and flash back to vapor source. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. May cause eye and skin irritation. Irritating to the respiratory system. May cause drowsiness and dizziness. Exposure to vapor may cause central nervous system depression (fatigue, dizziness, headache, collapse, coma and death) and, possibly, cardiac sensitization. Contains material which can cause cancer. Mutagenic Substance. This material also contains components that may cause hearing loss and may be a developmental toxin. Harmful to aquatic organisms.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state
 liquid



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Color

colorless to light yellow

Odor

Gasoline or naphtha odor. characteristic

Odor Threshold

No Data Available.

Potential health effects

Routes of exposure

Skin. Inhalation. Eye.

Acute effects

Inhalation hazard. May cause drowsiness and dizziness.

- *Xylene 1330-20-7*

May be irritating to the eyes, skin, and respiratory system. Aspiration hazard. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Trimethyl benzene 25551-13-7*

CNS depressant. Aspiration hazard.

- *Methyl Cyclohexane 108-87-2*

Liquid, mist, or vapors can cause eye, skin and respiratory tract irritation. CNS depressant. Exposure to excess vapor may cause headache, fatigue, drowsiness and dizziness.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *1,2,4-Trimethylbenzene 95-63-6*

May cause eye and skin irritation. Respiratory tract irritant. CNS depressant. Aspiration hazard.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *Indene 95-13-6*

May cause drowsiness and dizziness. Aspiration into the lungs may cause chemical pneumonia.

- *Naphthalene 91-20-3*

May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Cumene 98-82-8*

Slight eye irritant. Slight skin irritant. Aspiration hazard. CNS depressant.

Skin

May produce skin irritation. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Inhalation

Can cause pulmonary edema if aspirated into lungs.

Eyes

May cause moderate irritation, including burning sensation, tearing, redness or swelling. Effects of eye irritation are reversible.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Ingestion

Aspiration may cause lung damage.

Chronic effects

Prolonged contact with the skin may cause mechanical irritation and subsequent dermatitis. Prolonged or repeated exposure to vapors may cause lung damage. Contains material which may cause cancer based on animal data. Contains material that may cause adverse reproductive effects.

- *Xylene 1330-20-7*

May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard.

- *Trimethyl benzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *Methyl Cyclohexane 108-87-2*

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *1,2,4-Trimethylbenzene 95-63-6*

Repeated or prolonged skin contact may defat the skin and produce dermatitis.

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *Indene 95-13-6*

No known chronic health effects.

- *Naphthalene 91-20-3*

Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Potential Cancer Hazard, see section 11.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Cumene 98-82-8*

This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans). Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. May cause kidney and/or lung damage.

Aggravated Medical Condition

Any pre-existing disorders or diseases of the: central nervous system (CNS) peripheral nervous system or heart

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Heavy Catalytic Cracked Distillate (Petroleum)	64741-54-4	265-055-7	100.0
Xylene	1330-20-7	215-535-7	5.0 <= 10.0
Trimethyl benzene	25551-13-7	247-099-9	5.0 <= 10.0
Methyl Cyclohexane	108-87-2	203-624-3	1.0 <= 5.0
Toluene	108-88-3	203-625-9	1.0 <= 5.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

1,2,4-Trimethylbenzene	95-63-6	202-436-9	<= 5.0
Ethyl Benzene	100-41-4	202-849-4	1.0 <= 2.0
Indene	95-13-6	202-393-6	0.5 <= 1.5
Naphthalene	91-20-3	202-049-5	0.5 <= 1.5
Benzene	71-43-2	200-753-7	0.1 <= 0.5
Cumene	98-82-8	202-704-5	<= 0.5

Typical composition

See section 16 for full text of risk phrases.

4. FIRST AID MEASURES

General advice

Causes skin irritation. May cause minor eye irritation. Aspiration into the lungs during swallowing or vomiting can cause lung damage, possibly leading to chronic lung dysfunction or death. Inhalation of vapors may cause signs of respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death), possible cardiac sensitization, and irritation of the eyes, nose and throat. Harmful: danger of serious damage to health by prolonged exposure through inhalation. May cause cancer. This substance may be genotoxic. Always observe self-protection methods. Move out of dangerous area. Do not leave the victim unattended. Remove contaminated shoes and clothing. Get medical attention immediately. Show this material safety data sheet to the doctor in attendance.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. Never use low boiling point naphthas for washing contaminated skin. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

Notes to physician

Inhalation may cause CNS depression. Overexposure may produce anesthetic or narcotic effects. Do not induce vomiting. Risk of damage to lungs exceeds poisoning risk. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard.

5. FIRE-FIGHTING MEASURES



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

< 23 °C (< 73.4 °F) ASTMD 56

Autoignition temperature

> 200 °C (> 392 °F)

Lower explosion limit

1.4 vol%

Upper explosion limit

7.6 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Dry chemical. CO₂. Water spray. Foam. Sand. LARGE FIRES: Water spray. Water fog. Foam. Dry chemical. CO₂. Sand.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

When exposed to ignition source in air, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. Releases flammable vapors below normal ambient temperatures. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Prevent fire extinguishing water from contaminating surface water or the ground water system. When fighting a fire, notify environmental authorities if liquid enters sewers or public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon monoxide and other toxic vapors.

Hazardous combustion products

Thermal decomposition may generate carbon monoxide, carbon dioxide, and perhaps other toxic vapors.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Extinguish all ignition sources. Stop leak if you can do it without risk. Evacuate/limit access. Restrict water use for cleanup. Notify fire and environmental authorities. Note: recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken. A vapor suppressing foam may be used to reduce vapors. DO NOT use water jet. Use clean non-sparking tools to collect absorbed material. On water, material is insoluble and floats. On water, contain/minimize dispersion/collect. Remove from surface water (e.g. by skimming or siphoning). The use of dispersants should be advised by an expert, and, if required, approved by local authorities.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Spills and leaks

Liquids/vapors may ignite. Contain/collect rapidly to minimize dispersion. Prevent spreading of vapors through sewers, ventilation systems and confined areas. Do not touch or walk through spilled material. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.

Prevent entry into waterways, sewers, basements or confined areas. If the product contaminates rivers and lakes or drains inform respective authorities. On water, material is insoluble and floats.

7. HANDLING AND STORAGE

Handling

Ensure all equipment is electrically grounded before beginning transfer operations. Eliminate every possible source of ignition. Spilled material can make walking hazardous, potentially causing falls and serious injury. Do not breathe vapor. Avoid contact with skin. Do not smoke. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Use good housekeeping practices during use, storage, transfer, and handling.

Storage

Store only in tightly closed, properly vented containers away from heat, sparks, open flame and strong oxidizing agents. Store closed drums with bung in up position. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Electrical installations / working materials must comply with the technological safety standards. Keep container tightly closed and properly labeled. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If mechanical ventilation is used, electrical systems should conform to U.S. National Electric Code. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. The type of respiratory protection will depend upon whether the maximum exposure concentration is known.

Consider the maximum period for wear. Organic vapor or supplied air respirator may be appropriate. Respirator selection and use should comply with OSHA 29 CFR 1910.134 or ANSI Z88.2.

Skin

Wear insulated gloves if contact with liquid is possible. Wear chemical resistant gloves such as: Glove material fluoroelastomer; material thickness 0.4 mm; break through time \geq 480 min. Gloves must be replaced after 8 hours of wear. The suitability for a specific workplace should be discussed with the producers of the protective gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Choose body protection according to the amount and concentration of the dangerous substance at the work place. Use PPE that is chemical resistant to the product and prevents skin contact. Fire retardant clothing is appropriate for routine occupational use.

Eyes

Safety glasses with side-shields Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Remarks

Wash hands before eating, drinking, smoking, or using toilet facilities. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Use good personal hygiene practices.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Benzene	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
Methyl Cyclohexane	NIOSH	IDLH	500 ppm	None.
	US (ACGIH)	TWA	400 ppm	None.
	US (OSHA)	TWA	500 ppm 2,000 mg/m ³	None.
Toluene	NIOSH	IDLH	1,200 ppm	None.
	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
Xylene	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.
	US (ACGIH)	STEL	150 ppm	None.
Ethyl Benzene	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
	NIOSH	IDLH	800 ppm	None.
Trimethyl benzene	US (OSHA)	TWA	25 ppm	None.
	US (ACGIH)	TWA	25 ppm	None.
Indene	US (ACGIH)	TWA	5 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Naphthalene	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	US (OSHA)	TWA	10 ppm 50 mg/m ³	None.
	NIOSH	IDLH	250 ppm	None.
Gasoline	US (ACGIH)	STEL	500 ppm	None.
	US (ACGIH)	STEL	500 ppm	None.
	US (ACGIH)	TWA	300 ppm	None.
	US (ACGIH)	TWA	300 ppm	None.
Benzene	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
	NIOSH	IDLH	500 ppm	None.
Ethyl alcohol	US (ACGIH)	STEL	1,000 ppm	None.
	US (OSHA)	TWA	1,000 ppm 1,900 mg/m ³	None.
	NIOSH	IDLH	3,300 ppm	None.
t-Butyl Methyl Ether	US (ACGIH)	TWA	50 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Appearance: liquid colorless, to, light yellow

Odor: Gasoline or naphtha odor. characteristic

Odor Threshold: No Data Available.

pH: not applicable

Boiling point/boiling range: ~ 27 - 238 °C (80.6 - 460.4 °F)

Melting/freezing point: Not applicable.

Flash point: < 23 °C (< 73.4 °F) ASTMD 56

Autoignition temperature: > 200 °C (> 392 °F)

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: 1.4 vol%

Upper explosion limit: 7.6 vol%

Explosive properties: Not explosive

Oxidizing properties: Not considered an oxidizing agent.

Vapor pressure: 4 - 240 kPa @ 37.8 °C (100.04 °F)

Evaporation rate: No Data Available.

Relative density: 0.88 @ 15 °C (59 °F)

Relative vapor density: > 1 (Air = 1.0)

Viscosity: < 1 mm²/s @ 37.8 °C (100.04 °F)

Water solubility: no data available

Partition coefficient: n-octanol/water: Not applicable.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks and open flame.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Incomplete combustion can result in the production of carbon monoxide, carbon dioxide and other toxic gases.

Hazardous polymerization

Not expected to occur.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

11. TOXICOLOGICAL INFORMATION

Product Information

Product Summary

Inhalation of high vapor concentrations can cause CNS-depression and narcosis. Inhalation of vapors in high concentration may cause shortness of breath (lung edema). Solvents may degrease the skin. Prolonged exposure may produce anesthetic and narcotic effects. (See Component Toxicity Information).

Acute toxicity

LC50 (Inh) rat >5.61 4 HOURS

LD50 (Oral) rat >5,000 MG/KG

LD50 (Skin) rabbit >2000 MG/KG

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Inhalation may cause CNS depression. Can cause pulmonary edema if aspirated into lungs.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Skin irritant. Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Eyes

Non-irritating to the eyes. Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Skin. Central nervous system. Blood. Liver. Kidneys.

Reproductive effects

Stream expected not to be toxic to reproduction based on toxicity information for streams having components in common with this stream.

Developmental Toxicity

Suspected of damaging the unborn child. Stream expected to be toxic to development based on toxicity information for components present in this stream.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Genetic Toxicity

Mutagenic Substance. May cause genetic defects. Stream expected to be mutagenic based on toxicity information for components present in this stream.

Carcinogenicity

May cause cancer. Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream.

COMPONENT INFORMATION

- *Heavy Catalytic Cracked Distillate (Petroleum)* 64741-54-4
- *Xylene* 1330-20-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	5000 PPM	4 HOURS
	mouse	3907 MG/KG	6 HOURS
	rat	4550 PPM	4 HOURS

LD50 (Oral) rat 4300 MG/KG

LD50 (Skin) rabbit >1700 MG/KG

Irritation

Skin

Moderate skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

This material is expected to be a mild eye irritant. Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Target Organs

Skin. Eye. central nervous system (CNS)

Repeated dose toxicity

Repeated inhalation exposures of rats to xylenes cause liver effects at 920 ppm (4.0 mg/L) and ototoxicity at \geq 800 ppm (3.48 mg/L). Repeated oral exposures to xylenes produce reductions in body weight in male rats at 500 mg/kg bwt/day; liver effects and hyaline droplet formation in male rats at \geq 150 mg/kg bwt/day; kidney effects in male and female rats at \geq 750 mg/kg bwt/day; and a reduction in bodyweight gain in male mice at \geq 250 mg/kg bwt/day. Repeated inhalation exposures of gerbils to \geq 160 ppm (0.70 mg/L) xylenes cause apparently irreversible CNS effects.

Reproductive effects

A reproductive toxicity study, two dominant lethal studies, and evaluation of reproductive organs in repeated dose studies indicate that xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at non-anesthetic doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

Results from animal studies demonstrate that xylenes may cause reduced fetal weight and delayed ossification, but not malformations, at inhalation dose levels causing no or only slight maternal toxicity (\geq 115 ppm or 0.5 mg/L). Slight neurobehavioral effects were noted in offspring of rats exposed to 500 ppm (2.2 mg/L) in the absence of maternal toxicity.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

- *Trimethyl benzene* 25551-13-7

Acute toxicity

LD50 (Oral) rat 8970 MG/KG

Irritation

Skin

Skin irritant.

- *Methyl Cyclohexane* 108-87-2

Acute toxicity

LD50 (Oral) rat > 3,200 MG/KG

Irritation

Skin

May be irritating to the skin. Repeated or prolonged contact with skin may cause dermatitis.

Eyes

May cause eye irritation.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Toluene* 108-88-3

Acute toxicity

LC50 (vapor) rat 7500 PPM 4 HOURS

rat 5,580 MG/KG BWT

Rabbit. > 5000 MG/KG BWT

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *1,2,4-Trimethylbenzene* 95-63-6

Acute toxicity

<u>LC50 (Inhl)</u>	rat	18 G/M3	4 HOURS
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Target Organs

Eye. Skin. Respiratory system. Central nervous system. Blood.

Repeated dose toxicity

Repeated inhalation exposures to 1,2,4-trimethyl-benzene causes changes in hematological parameters in male rats at 250 ppm (1.23 mg/L); and pulmonary lesions in male and female rats at \geq 100 ppm (1.23 mg/L).

Developmental Toxicity

Results from a repeated dose inhalation test with trimethylbenzene showed fetotoxicity in rats (decreased pup bodyweight) at \geq 600 ppm (2.95 mg/L) in the presence of maternal toxicity (reduced body weight gain).

Genetic Toxicity

Trimethylbenzene was positive in a bacterial gene mutation assay and produced sister chromatid exchanges in mouse bone marrow (at \geq 730 mg/kg bwt), but did not induce micronuclei in the same cells.

- *Ethyl Benzene* 100-41-4

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of ≥ 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK⁺ locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *Indene 95-13-6*

Acute toxicity

LC50 (Inhl) rat 14 GM/M3

Carcinogenicity

Specific data not available.

- *Naphthalene 91-20-3*

Acute toxicity

LC50 (Inhl) rat >340 MG/M3 4 HOUR

LD50 (Oral)

rat	490 MG/KG
mouse	533 MG/KG
guinea pig	1200 MG/KG

Irritation

Skin

Maybe irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Repeated inhalation or ingestion of naphthalene causes methemoglobin*

Developmental Toxicity

Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bwt/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bwt/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice).

Genetic Toxicity

Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bwt orally or 250 mg/kg bwt by intraperitoneal injection.

Carcinogenicity

The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).

- *Benzene 71-43-2*

Acute toxicity

rat 13,700 PPM 4 HOURS

rabbit > 8260 MG/KG BWT

Acute effects

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered body weight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic *in vivo*, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Cumene* 98-82-8

Acute toxicity

<u>LC50 (Inh)</u>	rat	39000 MG/M3	4 HOURS
<u>LD50 (Oral)</u>	rat	1400 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 3160 MG/KG	

Irritation

Skin

Slight skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

Slight eye irritant.

Sensitization

Not expected to be a sensitizer.

Target Organs

Central nervous system. Skin. Eye. Respiratory system. Nasal cavity. Kidney Liver Lungs

Reproductive effects

This substance is not expected to be a reproductive toxicant.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Genetic Toxicity

Negative for genotoxicity using both in vitro and in vivo tests.

Carcinogenicity

The NTP has found that Cumene causes increased incidences of combined benign and malign kidney tumors in male rats, and malignant lung tumors in mice of both sexes. This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans).

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Toxic to aquatic life with long lasting effects.

Acute Fish toxicity

LL50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 10 mg/l

LL50 / 96 HOURS *Pimephales promelas* (fathead minnow) 8.2 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS *Daphnia magna* (Water flea) 4.5 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 3.1 mg/l

NOELR / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 0.5 mg/l

Toxicity to microorganisms

EC50 / 40 HOURS *Tetrahymena pyriformis* (ciliated protozoa) 15.41 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOELR / 14 d fish. 2.6 mg/l

Summary: QSAR (Quantitative structure-activity relationship) based calculation predicts low chronic toxicity.

Chronic toxicity to aquatic invertebrates

NOELR / 21 d *Daphnia magna* (Water flea) 2.6 mg/l

Environmental fate and pathways

If released to water it will float. This material is likely to evaporate from soil and water.

Mobility

Behavior in environmental compartments: Partitioning mainly to air.

Predicted distribution to environmental compartments: The product will be dispersed amongst the various environmental compartments (soil/ water/ air).

Persistence and degradability

Biodegradation: Not expected to be hydrolytically unstable. Not readily, but considered likely to be inherently biodegradable.

Bioaccumulation: This material may bioaccumulate.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

COMPONENT INFORMATION

- *Heavy Catalytic Cracked Distillate (Petroleum)* 64741-54-4

Ecotoxicity

Environmental fate and pathways

- *Xylene* 1330-20-7

Ecotoxicity

This material is classified as harmful to fish.

Acute Fish toxicity

LC50 / 96 HOUR rainbow trout 13.5 mg/l

LC50 / 24 HOUR goldfish 13 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Expected to have moderate mobility in soils. Volatilization from moist soil surfaces is expected. Volatilization from dry soil surfaces is expected.

Persistence and degradability

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Methyl Cyclohexane* 108-87-2

Ecotoxicity

This material may be harmful to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR Golden shiner (*notemigonus crysoleucas*) 72 mg/l

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

No Data Available.

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 55 mg/l

LC50 / 96 HOUR *Carassius auratus* 22.8 mg/l

LC50 / 96 HOUR *Pimephales promelas* 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY *Oncorhynchus* sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY *Daphnia magna*. 1.0 mg/l

NOEC / 7 DAY *Ceriodaphnia dubia* 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *1,2,4-Trimethylbenzene* 95-63-6

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS fathead minnow 7.72 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna*. 6.14 mg/l

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

No Data Available.

- *Ethyl Benzene* 100-41-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 / 96 HOUR *Menidia menidia* 5.1 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna* 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

- *Indene* 95-13-6

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Naphthalene* 91-20-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS rainbow trout. 26 mg/l

Summary: Very toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 21.9 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: Naphthalene has a moderate tendency to bioaccumulate although fish and microorganisms readily metabolize it.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

/ 96 HOURS Oncorhynchus mykiss (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

/ 48 HOURS Daphnia magna. 10 mg/l

Toxicity to aquatic plants

/ 72 HOURS Pseudokirchneriella subcapitata (green algae) 32 mg/l

Toxicity to microorganisms

/ 24 HOURS Nitrosomonas sp. 13 mg/l

Chronic toxicity to fish

/ 32 DAY Pimephales promelas 1.6 mg/l

Chronic toxicity to aquatic invertebrates

/ 7 DAY Ceriodaphnia dubia 3 mg/l

Environmental fate and pathways

Mobility



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for bioaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Cumene* 98-82-8

Ecotoxicity

This material is toxic to fish. It may cause long term adverse effects in the aquatic environment.

Acute Fish toxicity

LC50 / 96 HOURS *Pimephales promelas* (fathead minnow) 6.04 - 6.61 mg/l

Summary: flow-through test

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 4.8 mg/l

Summary: flow-through test

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 2.7 mg/l

Summary: semi-static test

LC50 / 96 HOURS *Poecilia reticulata* (guppy) 5.1 mg/l

Summary: semi-static test

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna* (Water flea) 0.6 mg/l

EC50 / 48 HOURS *Daphnia magna* (Water flea) 7.9 - 14.1 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Pseudokirchneriella subcapitata* 2.6 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals. It may adsorb onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process. Volatilization from moist soil surfaces is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: This material is expected to be readily biodegradable.

Bioaccumulation: Bioconcentration factor (BCF) ~ 35 BCF ~ 35.0

13. DISPOSAL CONSIDERATIONS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

Contaminated product, soil, water, and empty containers may be hazardous wastes due to possible presence of flammable gases. Assure emissions comply with applicable regulations. Proper grounding procedures to avoid static electricity should be followed. The product should not be allowed to enter drains, water courses or the soil. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) characteristics. Contact the RCRA/ Superfund Hotline at (800)424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product. If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product. This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

Proper shipping name Petroleum distillates, n.o.s. (XYLENE, TRIMETHYLBENZENES)

Reportable quantity XYLENE
BENZENE

ID No. UN1268

Hazard class 3

Packing group I

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
European Union	EINECS
Korea	ECL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
n-Hexane		5000 lbs
Benzene		10 lbs
Toluene		1000 lbs
Xylene		100 lbs
Ethyl Benzene		1000 lbs
Naphthalene		100 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

SARA 311/312

Fire Hazard.
 Delayed (Chronic) Health Hazard.
 Immediate (Acute) Health Hazard.

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

<u>Component</u>	<u>Reporting Threshold</u>
n-Hexane	1.0%
Benzene	0.1%
Toluene	1.0%
Xylene	1.0%
Ethyl Benzene	0.1%
Naphthalene	0.1%

State Reporting

Known to the State of California to cause cancer.

71-43-2	Benzene	(December 11, 2009)
100-41-4	Ethyl Benzene	
91-20-3	Naphthalene	

Known to the State of California to cause birth defects.

71-43-2	Benzene	(December 11, 2009)
108-88-3	Toluene	

Known to the State of California to cause reproductive toxicity in males.

71-43-2	Benzene	(December 11, 2009)
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Known to the State of California to cause reproductive toxicity in females.

108-88-3	Toluene	(December 11, 2009)
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This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

110-54-3	n-Hexane
71-43-2	Benzene
108-87-2	Methyl Cyclohexane
108-88-3	Toluene
1330-20-7	Xylene
100-41-4	Ethyl Benzene
25551-13-7	Trimethyl benzene
95-13-6	Indene
91-20-3	Naphthalene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

110-54-3	n-Hexane
71-43-2	Benzene
108-87-2	Methyl Cyclohexane
108-88-3	Toluene
1330-20-7	Xylene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE156
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 05/20/2011

FLUID GASOLINE HVY

100-41-4 Ethyl Benzene
 25551-13-7 Trimethyl benzene
 95-13-6 Indene
 91-20-3 Naphthalene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

110-54-3 n-Hexane
 71-43-2 Benzene
 108-87-2 Methyl Cyclohexane
 108-88-3 Toluene
 1330-20-7 Xylene
 100-41-4 Ethyl Benzene
 25551-13-7 Trimethyl benzene
 95-13-6 Indene
 91-20-3 Naphthalene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. May 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

APO248
 HER# 1,1,1

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: VGO

Number: 00000000000014936

CAS-No.: 64741-57-7

Chemical Name: Gas oils (petroleum), heavy vacuum

Synonyms: Vacuum Gas Oil, VGO, Heavy Vacuum Gas Oil, HVGO, Heavy Gas Oil, Heavy Vacuum Distillate, Partially Refined Heavy Gas Oil, Feedstock to the 634 Hydrodesulfurization Unit, Untreated FCCU Feedstock, Cracker Unit Feedstock, No. 6 Fuel Oil Blending Component, Heavy Fuel Oil Blending Component, Unfinished Bunker Fuel, C20-C50 Petroleum Hydrocarbons, Vacuum Tower Heavy Gas Oil from a Petroleum Crude Still, Vacuum Tower Sidestream

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

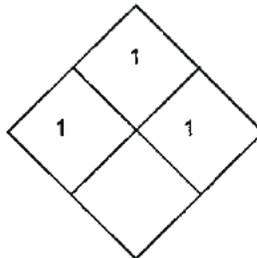
Signal Word

WARNING.

Hazards

May cause irritation of the skin. Contact with hot liquid may cause burns. Repeated exposure may cause cracking and drying due to the extraction of oils. Heavier than air, vapors may travel long distances along the ground before igniting and flash back to vapor source. Hydrogen sulfide (H₂S) and other hazardous vapors may evolve and collect in the headspace of storage tanks and other enclosed vessels. H₂S is an extremely flammable and a highly toxic gas. Inhalation hazard. Contain 4-to-6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbazoles. May cause genetic defects. May affect the unborn. Potential cancer hazard.

NFPA®



HMIS®

Health	*	1
Flammability		1
Physical Hazard		1

Physical state

liquid

Color

dark brown black



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Odor

characteristic

Odor Threshold

No value available.

Potential health effects

Routes of exposure

Skin. Eye. Inhalation.

Acute effects

Skin

Prolonged or repeated contact may cause skin to become dry or cracked. This material may contain polynuclear aromatic hydrocarbons (PAH), some of which induced skin tumors on laboratory animals upon prolonged and repeated exposure. Prolonged or repeated contact may cause skin to become dry or cracked. This material may contain polynuclear aromatic hydrocarbons (PAH), some of which induced skin tumors on laboratory animals upon prolonged and repeated exposure. May cause irritation of the skin. Contact with hot liquid may cause burns. May be absorbed through the skin and produce toxic effects such as CNS depression. Short-term contact symptoms include redness, itching, and burning of the skin. If the skin is damaged, absorption increases.

Inhalation

May be irritating to respiratory system. May be irritating to respiratory system. Ingestion of large quantities can cause intestinal obstruction. Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression.

Eyes

Not expected to cause eye irritation. Not expected to cause eye irritation. May cause minimal irritation. Animal test results on similar unheated materials suggest that this product may cause minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness. H₂S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).

Ingestion

Not a likely route of exposure. Ingestion would likely cause gastrointestinal tract irritation. Not a likely route of exposure. Ingestion would likely cause gastrointestinal tract irritation. Contact with hot material may cause thermal burns. If swallowed, no significant adverse health effects are anticipated; however, this material can cause a laxative effect. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. Concentrations of H₂S at or below 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, and/or low blood pressure. At greater than 500 ppm, H₂S causes sudden collapse, unconsciousness, and respiratory paralysis leading to convulsions, coma, and/or death. (See Section 11). May be harmful or fatal if inhaled.

Aggravated Medical Condition

Persons with pre-existing central nervous system (CNS) disease, skin disorders, impaired kidney function or chronic respiratory disease should avoid exposure. Any pre-existing disorders or diseases of the: lungs and/or Liver disease.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Heavy Vacuum Gas Oil	64741-57-7	265-058-3	100.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Typical composition

4. FIRST AID MEASURES

General advice

May cause cancer. This substance may be genotoxic. May cause harm to the unborn child. Harmful by inhalation. Harmful: danger of serious damage to health by prolonged exposure in contact with skin. Inhalation of heated vapors or mists may cause central nervous system (CNS) effects including headache, drowsiness, dizziness, and blurred vision and possible cardiac sensitization.

Ingestion may cause CNS effects, discomfort and irritation of the gastrointestinal tract, nausea, vomiting, and diarrhea.

May be irritating to the eyes. May be irritating to the skin. Repeated exposure may cause skin dryness or cracking. Very toxic by inhalation. H₂S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light). Always observe self-protection methods. Move out of dangerous area. Do not leave the victim unattended. Remove contaminated shoes and clothing. Get medical attention immediately. Show this material safety data sheet to the doctor in attendance.

Skin

All contaminated clothingshould be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. DO NOT use gasoline, kerosene, solvents, or harsh abrasive skin cleaners. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

Notes to physician

Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class III B combustible liquid.

Flash point

> 180 °C (> 356 °F)

Autoignition temperature

No Data Available.

Lower explosion limit



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Lower explosion limit
not determined

Upper explosion limit
not determined

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use water spray, dry chemical, foam, or carbon dioxide. Sand LARGE FIRES: Water spray Foam Water fog. Sand Carbon dioxide (CO₂) Dry chemical Apply water carefully to avoid frothing/steam explosion.

Unsuitable extinguishing media

Do not use a solid water stream as it may scatter and spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

This material will release vapors when heated above the flash point temperature that can ignite when exposed to a source of ignition. Vapors may travel long distances along the ground before reaching a source of ignition and flashing back. Move containers from fire area if you can do it without risk. Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Contents under pressure and can explode when exposed to heat or flames. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Burning liquid may float on water. Apply aqueous extinguishing media carefully to any molten/liquid material to prevent frothing/steam explosion. Prevent fire extinguishing water from contaminating surface water or the ground water system. Notify authorities immediately if liquid enters sewer/public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

Hazardous combustion products

Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke). May also include hydrogen sulfide, sulfur oxides or sulfuric acid.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Contain/collect rapidly to minimize dispersion. Release causes immediate fire/explosion hazard. Evacuate/limit access. Eliminate all sources of ignition. If liquid is hot, let cool naturally. Notify fire and environmental authorities. Note: recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken. Use clean non-sparking tools to collect absorbed material. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. For large spills: Contain spill with dike to prevent entry into sewers or waterways. Water spray may reduce vapor; but may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. DO NOT use water jet. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place contaminated materials into appropriate containers for disposal. On water, contain/minimize dispersion/collect. Remove from surface water (e.g. by skimming or siphoning). The use of dispersants should be advised by an expert, and, if required, approved by local authorities.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Prevent entry into waterways, sewers, basements or confined areas. If the product contaminates rivers and lakes or drains inform respective authorities.

7. HANDLING AND STORAGE

Handling

Use only with adequate ventilation and in closed systems. Ensure all equipment is electrically grounded before beginning transfer operations. Eliminate all sources of ignition. Liquid material is slippery-remove small leaks/spills from walking surface with solid absorbent. Odor is not an adequate warning of potentially hazardous ambient air concentrations. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Check atmosphere for explosiveness and oxygen deficiencies. (Subject to applicability): Concentration of hydrogen sulfide (H₂S) in tank headspaces may reach hazardous values, especially in case of prolonged storage. This situation is especially relevant for those operations which involve direct exposure to the vapors in the tank.

If sulfur compounds are suspected to be present in the product, check the atmosphere for hydrogen sulfide (H₂S) content. Do not handle near heat, sparks, or open flame. Use good housekeeping practices during use, storage, transfer, and handling. Electrostatic charges may be generated as a result of flow or agitation. Do not use compressed air for filling, discharging or handling. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. This liquid may accumulate static electricity even when transferred into properly grounded containers. Always keep nozzle in contact with the container throughout the loading process. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Use only non-sparking tools. Avoid contact with incompatible agents. Handle empty containers with care; vapor/residue may be flammable. Ensure that all relevant regulations regarding explosive atmospheres, and handling and storage facilities of flammable products are followed.

Storage

Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Electrical installations / working materials must comply with the technological safety standards. Hydrogen sulfide (H₂S) and other hazardous vapors may evolve and collect in the headspace of storage tanks and other enclosed vessels. H₂S is an extremely flammable and a highly toxic gas. Store in original container. Store closed drums with bung in up position. Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room. Bonding and grounding measures may not be enough if nonconductive flammables are involved. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Storage area layout, tank design, equipment and operating procedures must comply with the relevant European, national or local legislation. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Engineering controls, preferably enclosed systems, should be used whenever feasible to maintain exposures below acceptable criteria. When such controls are not feasible, or sufficient to achieve full conformance, other engineering controls such as local exhaust ventilation should be used. Where engineering controls are not feasible use adequate local exhaust ventilation wherever mist, spray or vapor may be generated. Provide local exhaust or general room ventilation to minimize exposure to vapors. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

Use an approved respirator, either air-supplied or air purifying (consult your company safety professional, or Equistar Industrial Hygiene group for guidance). The type of respiratory protection will depend upon whether the maximum exposure concentration is known. Consider the maximum period for wear. If exposure exceeds the standard limits, respiratory protection equipment which meets 29 U.S. Code of Federal Regulations (CFR) 1910.134 and is U.S. National Institute for Occupational Safety and Health (NIOSH) approved must be worn. Organic vapor or supplied air respirator may be appropriate. Respirator selection and use should comply with OSHA 29 CFR 1910.134 or ANSI Z88.2.

Skin



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Impervious gloves Wear chemical resistant gloves such as: Neoprene, Nitrile, Vinyl Butyl Rubber Gloves, or PVC. Avoid contact with skin. Skin should be washed after contact. Flame retardant protective clothing. Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. Avoid contact with skin. Immediately remove all contaminated clothing. Use PPE that is chemical resistant to the product and prevents skin contact.

Eyes

Wear safety glasses. Where the opportunity for a splash or spray caused by high pressure or agitation of the material is possible, use a face shield and chemical goggles.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Hydrogen sulfide	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	20 ppm	None.
	NIOSH	IDLH	100 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid dark brown, black

Odor: characteristic

Odor Threshold: No value available.

pH: not applicable not applicable Not applicable.

Boiling point/boiling range: > 150 - 750 °C (302 - 1,382 °F)

Melting/freezing point: < 30 °C (< 86 °F)

Flash point: > 180 °C (> 356 °F)

Autoignition temperature: No Data Available.

Flammability: OSHA/NFPA Class IIIB combustible liquid.

Lower explosion limit: not determined

Upper explosion limit: not determined

Explosive properties: Not applicable. (No chemical groups associated with explosive properties.)

Oxidizing properties: No Data Available.

Vapor pressure: 0.02 - 0.791 kPa @ 120 °C (248 °F) (MW 330 to 500) 0.063 - 0.861 kPa @ 150 °C (302 °F) (MW 350 to 420)

Evaporation rate: Not applicable.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Relative density: 0.8 - 1.2

Relative vapor density: 10 @ 21.1 °C (69.98 °F)(Air = 1.0)

Viscosity: > 20.5 mm²/s @ 40 °C (104 °F)

Water solubility: no data available

Partition coefficient: n-octanol/water: no data available

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Conditions to avoid

Heat, flames and sparks. Avoid static discharge or other sources of ignition. Electrostatic charges may be generated as a result of flow or agitation.

Materials to avoid

Strong acids and oxidizing agents

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

No known chronic health effects.

Acute toxicity

<u>LC50 (aerosol)</u>	rat	4.1 MG/L
<u>LD50 (Oral)</u>	rat	4,320 MG/KG
<u>LD50 (Skin)</u>	rabbit	> 2000 MK/KG

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Stream expected to be no more than slightly irritating to the skin based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as a skin irritant



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Damages developing fetus.

Repeated dose toxicity

May cause damage to organs through prolonged or repeated exposure. Stream expected to be toxic to target organs with repeated exposure based on toxicity information for streams having components in common with this stream. Results of repeated exposure toxicity testing indicate alterations in serum cholesterol and blood urea nitrogen at high dermal doses accompanied by red blood cell, platelet, liver, and thymus effects at lower exposure levels.

Reproductive effects

Stream expected not to be toxic to reproduction based on toxicity information for streams having components in common with this stream.

Developmental Toxicity

Suspected of damaging the unborn child. Stream expected to be toxic to development based on toxicity information for streams having components in common with this stream. Results of developmental toxicity testing indicate alterations in fetal and pup development, which sometimes occurred in the presence of maternal toxicity.

Genetic Toxicity

Not mutagenic. Stream expected to be not mutagenic based on toxicity information for streams having components in common with this stream.

Carcinogenicity

Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream. Results obtained from the modified Ames test, from mouse skin painting tests and initiation/promotion assay along with chemical (PAH) analysis indicate that Heavy Fuel Oil streams are carcinogenic.

12. ECOLOGICAL INFORMATION

Product Information

Ecotoxicity

No additional information available.

Acute Fish toxicity

LL50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 79 mg/l

Acute toxicity to aquatic invertebrates

static test / 48 HOURS Daphnia magna (Water flea) 2 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS 0.75 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Toxicity to microorganisms

LL50 / 0.72 HOURS Tetrahymena pyriformis (ciliated protozoa) > 1,000 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOEC / 0.1 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to aquatic invertebrates

NOEL / 0.27 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Environmental fate and pathways

No additional information available.

Mobility

Predicted distribution to environmental compartments: Predicted distribution to environmental compartments Partitioning mainly to Soil

Persistence and degradability

Biodegradation: Not expected to be hydrolytically unstable. Not expected to be biodegradable.

Bioaccumulation: Consideration of representative hydrocarbon structures indicated none are likely to be highly bioaccumulative.

13. DISPOSAL CONSIDERATIONS

Dispose of as hazardous waste in compliance with local and national regulations. The product should not be allowed to enter drains, water courses or the soil. Proper grounding procedures to avoid static electricity should be followed. Can be incinerated, when in compliance with local regulations. Contaminated product, soil or water should be considered dangerous due to potential evolution of flammable vapor. Contaminated product, soil or water may be hazardous waste due to potentially low flash point.

14. TRANSPORT INFORMATION

Proper shipping name Oil, Residual, not regulated

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Japan	ENCS/ISHL
Korea	ECL
Philippines	PICCS
United States of America	TSCA



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

VGO

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Hydrogen sulfide	500lbs	100 lbs

SARA 313

This product contains no known chemicals regulated under SARA 313.

State Reporting

This product contains no known chemicals regulated by California's Proposition 65.

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:
 7783-06-4 Hydrogen sulfide

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:
 7783-06-4 Hydrogen sulfide

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:
 7783-06-4 Hydrogen sulfide

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:
 Revised Section(s): 1 2 4 8 9 11 12 January 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE194
Variant: U.S.A.-EN
Revision: 1.0
Validation Date: 02/15/2011

VGO



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

APO270
 HER# 1,2,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: KEROSENE/JET FUEL

Number: 00000000000016109

Chemical characterization: Kerosene (Petroleum)

CAS-No.: 64742-81-0

Synonyms: Fungible Aviation Kerosene; Fungible Aviation Turbine Engine; Turbo Fuel A; 55 Grade Turbine Fuel; Aviation Turbine Fuel Jet A; JP_1 Military Aviation Turbine Jet Fuel; Low Sulfur Aviation Fuel, Turbine Jet A Fuel, DED Kerosene,, Colonial Pipeline Code FGX-51, Hydrodesulfurized (HDS) Kerosene (Petroleum), Jet Fuel A, Hydrodesulfurized Light Distillate, HDS Light Distillate, HDS Water White Distillate, C9-C16 Petroleum Hydrocarbons, Kerosene (Petroleum), Fuel No1. Oil, Mixture

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

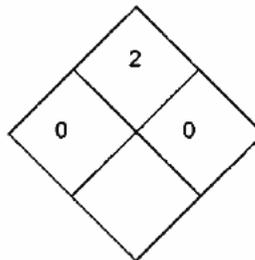
Signal Word

WARNING.

Hazards

Flammable. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. Irritating to the skin, not a sensitizer. Harmful if swallowed. Ingestion of this material may result in aspiration into the lungs causing chemical pneumonia. Combustible liquid. MAY BE HARMFUL IF SWALLOWED. Ingestion of this material may result in aspiration into the lungs causing chemical pneumonia. Irritating to the skin, not a sensitizer. Can cause eye irritation. Possible CANCER hazard

NFPA®



HMIS®

Health	*	1
Flammability		2
Physical Hazard		0

Physical state

liquid

Color

Clear, colorless to light amber.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Odor

Hydrocarbon.

Odor Threshold

Specific data not available.

Potential health effects

Routes of exposure

Skin. Inhalation. Ingestion.

Acute effects

Skin

Skin irritant.

Inhalation

Aspiration may cause lung damage.

Eyes

Not expected to cause eye irritation.

Ingestion

Swallowing this material may result in health hazard.

Chronic effects

Repeated or prolonged exposure may cause respiratory irritation. Prolonged exposure may produce anesthetic and narcotic effects.

Aggravated Medical Condition

Persons with pre-existing chronic respiratory disease or skin disorders should minimize their exposure to this material.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Kerosene, petroleum, hydrodesulfurized	64742-81-0	265-184-9	0.0 <= 100.0
Naphthalene	91-20-3	202-049-5	0.0 <= 3.0
Ethyl Benzene	100-41-4	202-849-4	0.0 <= 1.0

Typical composition

4. FIRST AID MEASURES

General advice

Causes skin irritation. May cause minor eye irritation. Aspiration into the lungs during swallowing or vomiting can cause lung damage, possibly leading to chronic lung dysfunction or death. Possible cardiac sensitization. May cause drowsiness or dizziness. Always observe self-protection methods. Move out of dangerous area. Do not leave the victim unattended.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

General advice

Get medical attention immediately. Show this material safety data sheet to the doctor in attendance. Remove contaminated shoes and clothing.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. Never use low boiling point naphthas for washing contaminated skin. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

Notes to physician

Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class II combustible liquid.

Flash point

> 23 °C (> 73.4 °F)

Autoignition temperature

> 200 °C (> 392 °F)

Lower explosion limit

~ 0.7 vol%

Upper explosion limit

~ 5 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Carbon Dioxide. Sand. Foam. Dry powder. Inert gas. Water fog. LARGE FIRES: water spray water fog foam. Apply water carefully to avoid frothing/steam explosion.

Unsuitable extinguishing media

Do not use a solid water stream as it may scatter and spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Move containers from fire area if you can do it without risk. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). This material releases flammable vapors at well below ambient temperatures and may form flammable mixtures with air. When mixed with air in certain proportions and exposed to an ignition source, these vapors can burn in the open or be explosive in confined spaces. Being heavier than air, these vapors may travel long distances along the ground before reaching a point of ignition and flashing back. The product will float and can be reignited on surface water. Burning liquid may float on water. Apply aqueous extinguishing media carefully to any molten/liquid material to prevent frothing/steam explosion. Prevent fire extinguishing water from contaminating surface water or the ground water system. Notify authorities immediately if liquid enters sewer/public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon monoxide and other toxic vapors.

Hazardous combustion products

Incomplete combustion will form carbon monoxide and other toxic vapors.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Combustible liquid. Release causes immediate fire/explosion hazard. Evacuate/limit access. Notify fire and environmental authorities. Note: recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material. For large spills: Contain spill with dike to prevent entry into sewers or waterways. Water spray may reduce vapor; but may not prevent ignition in closed spaces. On water, contain/recover rapidly to minimize dispersion. Remove from surface water (e.g. by skimming or siphoning). The use of dispersants should be advised by an expert, and, if required, approved by local authorities.

Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. The spilled material and any soil or water which it has contacted will be hazardous to animals and/or aquatic life.

Prevent entry into waterways, sewers, basements or confined areas. If the product contaminates rivers and lakes or drains inform respective authorities.

7. HANDLING AND STORAGE

Handling

Eliminate every possible source of ignition. Check atmosphere for explosiveness and oxygen deficiencies. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Electrostatic charge may build up during handling. Equipment should be grounded and bonded. During transfer of product, ground container and insure that all conveying equipment is properly grounded. A static ignition hazard can exist when low vapor pressure products such as diesel, heating oil, kerosene or jet fuels are loaded into a cargo tank containing flammable vapors from a previous load of a low flash point solvent. Always keep nozzle in contact with the container throughout the loading process. Use only non-sparking tools. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Handling

Refer to NFPA 77 for relevant consensus guidance. Keep container closed and drum bungs in place. Store away from heat, sparks, open flames, strong oxidizing agents and direct sunlight. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Never siphon by mouth. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Wash thoroughly after handling with soap and water. Do not use compressed air for filling, discharging or handling. Liquid material is slippery-remove small leaks/spills from walking surface with solid absorbent. Do not pressurize or expose empty containers to open flame, sparks, or heat. Observe precautions pertaining to confined space entry.

Storage

Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Store away from heat, sparks, open flames, strong oxidizing agents and direct sunlight. Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room. Keep in properly labeled containers. Bonding and grounding measures may not be enough if nonconductive flammables are involved. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Electrical installations / working materials must comply with the technological safety standards. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Store closed drums with bung in up position. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If mechanical ventilation is used, electrical systems should conform to U.S. National Electric Code. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

A respiratory protection program which complies with U.S. Occupational Safety and Health Administration (OSHA) general industry standard 1910.134(e) should be implemented. Where exposure through inhalation may occur from use, approved respiratory protection equipment is recommended. Not expected to present a respiratory hazard due to normally low vapor pressures. Where excessive vapor, mist, or dust may result from use, use approved respiratory protection equipment. NIOSH approved organic vapor respirator equipped with a dust/mist prefilter should be used. For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA).

Skin

Wear chemical resistant gloves such as: Glove material fluoroelastomer; material thickness 0.4 mm; break through time \geq 480 min. Gloves must be replaced after 8 hours of wear. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Use PPE that is chemical resistant to the product and prevents skin contact. Fire retardant clothing is appropriate for routine occupational use.

Eyes

Wear safety glasses. Where the opportunity for a splash or spray caused by high pressure or agitation of the material is possible, use a face shield and chemical goggles. Suitable eye wash water should be readily available.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Use good personal hygiene practices. Remove and wash contaminated clothing before re-use.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Kerosene, petroleum, hydrodesulfurized	US (ACGIH)	TWA	200 mg/m ³ total hydrocarbon vapor,	None.
			15 ppm	None.
Naphthalene	US (ACGIH)	STEL	10 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	US (OSHA)	TWA	10 ppm 50 mg/m ³	None.
	NIOSH	IDLH	250 ppm	None.
Ethyl Benzene	US (ACGIH)	STEL	125 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
	NIOSH	IDLH	800 ppm	None.
Benzene	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
Toluene	NIOSH	IDLH	500 ppm	None.
	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Clear, colorless to light amber.

Odor: Hydrocarbon.

Odor Threshold: Specific data not available.

pH: Not applicable.

Boiling point/boiling range: 90 - 300 °C (194 - 572 °F)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Melting/freezing point: < -20 °C (< -4 °F)

Flash point: > 23 °C (> 73.4 °F)

Autoignition temperature: > 200 °C (> 392 °F)

Flammability: OSHA/NFPA Class II combustible liquid.

Lower explosion limit: ~ 0.7 vol%

Upper explosion limit: ~ 5 vol%

Explosive properties: Not applicable. (No chemical groups associated with explosive properties.)

Oxidizing properties: Not considered an oxidizing agent.

Vapor pressure: 1 - 21 kPa @ 37.8 °C (100.04 °F)

Evaporation rate: No Data Available.

Relative density: 0.775 - 0.840 @ 15 °C (59 °F)

Relative vapor density: < 1 (Air = 1.0)

Viscosity: 1 - 2.5 mm²/s @ 40 °C (104 °F)
 2.9 - 12 mm²/s @ 20 °C (68 °F)

Water solubility: 0.005 - 0.12 g/l

Partition coefficient: n-octanol/water: Log Kow >3.3

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks and open flame.

Materials to avoid

Strong acids, bases, and oxidizing agents, such as liquid chlorine and oxygen. May react with peroxides.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Aspiration may cause lung damage. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death. May produce skin irritation.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Product Summary

Inhalation of vapors in high concentration may cause irritation of respiratory system. Inhalation may cause CNS depression.

Acute toxicity

<u>LC50 (Inh)</u>	rat	5.28	4 HOURS
<u>LD50 (Oral)</u>	rat	>5000 MG/KG	
<u>LD50 (Skin)</u>	Rabbit	>2000 MG/KG	

Acute effects

Inhalation

Predicted exposure concentration Inhalation may cause CNS depression. Can cause pulmonary edema if aspirated into lungs. Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Skin. Lungs

Repeated dose toxicity

The repeated inhalation and oral studies of kerosene in rats produced no consistent toxicological effects other than changes in male rat kidneys (alpha-2u-globulin nephropathy). Dermal studies indicate a very low potential for systemic toxicity, however, repeated treatment at high levels can produce quite severe dermal effects at the application site.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Acute Fish toxicity

LL50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 2 - 5 mg/l

NOEL / 2 mg/l

LL50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 2 - 100 mg/l

NOEL / 6.8 - 10 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS Daphnia magna (Water flea) 1.4 mg/l

NOEL / 0.3 mg/l

EL50 / 48 HOURS Daphnia magna (Water flea) 1.9 - 89 mg/l

NOEL / 0.3 - 40 mg/l

Environmental fate and pathways

Mobility

Predicted distribution to environmental compartments: Predicted distribution to environmental compartments After release, disperses into the air.

Persistence and degradability

Stability in water: Volatilization from water surfaces is expected to be an important environmental fate process.

Biodegradation: Not readily, but considered likely to be inherently biodegradable. Photodegradation following atmospheric release is not expected to be a significant route of degradation in the environment.

Bioaccumulation: The substance is a hydrocarbon UVCB. Consideration of representative hydrocarbon structures indicated none are likely to be highly bioaccumulative.

13. DISPOSAL CONSIDERATIONS

The product should not be allowed to enter drains, water courses or the soil. Proper grounding procedures to avoid static electricity should be followed. Contaminated product, soil or water may be hazardous waste due to potentially low flash point. Contaminated product, soil or water should be considered dangerous due to potential evolution of flammable vapor.

14. TRANSPORT INFORMATION

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	TECS
European Union	EINECS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZbC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Ethyl Benzene		1000 lbs
Naphthalene		100 lbs
Benzene		10 lbs
Toluene		1000 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Fire Hazard.
 Delayed (Chronic) Health Hazard.
 Immediate (Acute) Health Hazard.

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

<u>Component</u>	<u>Reporting Threshold</u>
Ethyl Benzene	0.1%
Naphthalene	0.1%
Benzene	0.1%
Toluene	1.0%

State Reporting

Known to the State of California to cause cancer.

100-41-4	Ethyl Benzene	(December 11, 2009)
91-20-3	Naphthalene	
71-43-2	Benzene	

Known to the State of California to cause birth defects.

71-43-2	Benzene	(December 11, 2009)
108-88-3	Toluene	

Known to the State of California to cause reproductive toxicity in males.

71-43-2	Benzene	(December 11, 2009)
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Known to the State of California to cause reproductive toxicity in females.

108-88-3	Toluene	(December 11, 2009)
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This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

100-41-4	Ethyl Benzene
91-20-3	Naphthalene
71-43-2	Benzene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE88
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 02/15/2011

KEROSENE/JET FUEL

108-88-3 Toluene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

100-41-4 Ethyl Benzene
 91-20-3 Naphthalene
 71-43-2 Benzene
 108-88-3 Toluene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

100-41-4 Ethyl Benzene
 91-20-3 Naphthalene
 71-43-2 Benzene
 108-88-3 Toluene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. January 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

AP0381

COKER FEED

HF# 3,2,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: COKER FEED

Number: 000000000000016099

Internal ID: AP0381

Chemical characterization: Mixture of Residuum Streams

CAS-No.: Mixture

Synonyms: Delayed Coker Unit Feedstock, Thermocracker Feedstock, Feedstock for 736 and 737 Coker Units, High-Aromatic Content Residuum, Mixture of Residuum Streams, Mixture Crude Vacuum Tower and Fluid Catalytic Cracker Unit Bottoms and Recovered Slop Oil, No. 6 Fuel Oil Blending Components, Heavy Fuel Oil Blending Components, Unfinished Bunker Fuel, C20-C50 Petroleum Hydrocarbons

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

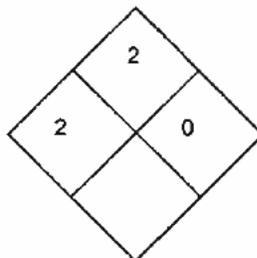
Signal Word

WARNING.

Hazards

Vapors and fumes may be hazardous or fatal. Avoid contact with hot product - may cause burns. If hot product contacts water, a violent eruption of steam and vapor may occur. May be irritating to the eyes, skin, and respiratory system. Contain 4-to-6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbazoles. Contains material which can cause cancer. Contains material which can cause mutagenic effects. Stream Components have been shown to cause reproductive and developmental toxicity in laboratory animals following repeated inhalation exposure. This stream contains genotoxic and carcinogenic components.

NFPA®



HMIS®

Health	*	3
Flammability		2
Physical Hazard		0

Physical state

viscous liquid



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Color

dark brown to black Red Brown to Black.

Odor

Slightly burnt odor. Hydrocarbon. Asphaltic odor. Hydrogen sulfide; rotten eggs.

Odor Threshold

No value available.

Potential health effects

Routes of exposure

Skin. Eye. Inhalation.

Acute effects

See component summary.

- *Hydrogen sulfide 7783-06-4*

Hydrogen sulfide is a highly toxic gas that can be fatal in certain concentrations. Skin absorption hazard. Respiratory tract irritant. Inhalation may cause asthma-like symptoms, including coughing, wheezing, tightness of chest, shortness of breath, and headache. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), with severe shortness of breath. CNS depressant.

Skin

Avoid contact with hot product - may cause burns. May cause moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. May be absorbed through the skin and produce toxic effects such as CNS depression. If the skin is damaged, absorption increases.

Inhalation

Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression.

Eyes

Symptoms include stinging, watering, and redness. H₂S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).

Chronic effects

Prolonged exposure may cause skin irritation.

- *Hydrogen sulfide 7783-06-4*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated exposure may cause eye damage with possible loss of vision.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Residues (petroleum) vacuum	64741-56-6	265-057-8	50.0 <= 90.0
Heavy catalytic cracked naphtha	64741-54-4	265-055-7	10.0 <= 30.0
Clarified oils (petroleum), catalytic cracked	64741-62-4	265-064-6	0.0 <= 20.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Slop Oil, C20+ Hydrocarbons	68476-53-9	270-692-9	0.0	<= 20.0
Hydrogen sulfide	7783-06-4	231-977-3	0.0	<= 0.01

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS. At ambient temperatures, product may cause slight skin or eye irritation. Hydrogen sulfide (H₂S) and other hazardous vapors may evolve and collect in the headspace of storage tanks and other enclosed vessels. H₂S is an extremely flammable and a highly toxic gas. Always observe self-protection methods. Move out of dangerous area. Do not leave the victim unattended. Get medical attention immediately. Show this material safety data sheet to the doctor in attendance.

Skin

If burned by hot material, cool skin by quenching with large amounts of cool water. Do not put ice on the burn. Do not attempt to remove portions of clothing glued to burnt skin but cut around them. Remove non-sticking garments carefully. Wash thoroughly with soap and water. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners. Never use low boiling point naphthas for washing contaminated skin. Seek medical attention if ill effect or irritation develops.

Inhalation

If symptoms develop from exposure to bitumen fumes, mists or vapour, remove victim to fresh air and keep at rest in a position comfortable for breathing.

If overcome by exposure to H₂S, remove victim to fresh air immediately. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

Continuously flush eye(s) with cool running water for at least 5 minutes. Beyond flushing, DO NOT attempt to remove the material adherent to the eye(s).

Seek immediate medical attention, preferably an ophthalmologist.

Ingestion

DO NOT induce vomiting. Rinse mouth with water. If vomiting does occur, have victim lean forward to reduce risk of aspiration.

Notes to physician

Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Concentrations of H₂S at or below 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, and/or low blood pressure. Pulmonary edema is a common complication from exposure to high concentrations of hydrogen sulfide while respiratory tract irritation occurs at lower concentrations.

H₂S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light). Following exposure to hydrogen sulfide, supportive care and oxygen may be sufficient to treat the victim without the need to use nitrites.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IIIA Combustible Liquid.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Flash point
 > 70 °C (> 158 °F)

Autoignition temperature
 400 °C (752 °F)

Lower explosion limit
 no data available

Upper explosion limit
 no data available

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemical, CO₂, water spray or regular foam. Inert gas. Sand. LARGE FIRES: Water spray. Foam. Dry chemical. Carbon dioxide (CO₂). Inert gas. Sand. Apply aqueous extinguishing media carefully to any molten/liquid material to prevent frothing/steam explosion.

Unsuitable extinguishing media

Do not use a solid water stream as it may scatter and spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear. Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

This material will release vapors when heated above the flash point temperature that can ignite when exposed to a source of ignition. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. Evacuate area and fight from a maximum distance or use unmanned hose holders or monitor nozzles. Heat may generate flammable or explosive vapors; disperse with water spray or cover pooling liquid with foam. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Move containers from fire area if you can do it without risk. Prevent fire extinguishing water from contaminating surface water or the ground water system. When fighting a fire, notify environmental authorities if liquid enters sewers or public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon monoxide and other toxic vapors.

Hazardous combustion products

Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke). May also include hydrogen sulfide, sulfur oxides or sulfuric acid.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Do not touch or walk through spilled material. If liquid is hot, attempt to confine spill and let the liquid solidify. Do not direct water at spill or source of leak. Stop leak if you can do it without risk. Use only non-sparking tools. All equipment used when handling this product must be grounded. Take measures to prevent the build up of electrostatic charge. Use mechanical handling equipment. In those cases when the presence of dangerous amounts of H₂S in the leaked/spilled product is suspected or proved, additional or special actions may be warranted, including access restrictions, use of special protection equipment, procedures and personnel training. All recovered material should be packaged, labeled, transported and disposed of or reclaimed in conformance with applicable laws and regulations and in conformance with good engineering practices. Reclaim where possible.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

7. HANDLING AND STORAGE

Handling

If sulfur compounds are suspected to be present in the product, check the atmosphere for hydrogen sulfide (H₂S) content.

The bulk temperature during handling should be kept as low as possible consistent with efficient discharge, and at no time should it exceed the maximum temperature recommended by the supplier.

Use adequate ventilation and/or engineering controls in high temperature processing to prevent exposure to vapors.

Check atmosphere for explosiveness and oxygen deficiencies. (Subject to applicability): Concentration of hydrogen sulfide (H₂S) in tank headspaces may reach hazardous values, especially in case of prolonged storage. This situation is especially relevant for those operations which involve direct exposure to the vapors in the tank.

Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Ensure all equipment is electrically grounded before beginning transfer operations. Smoking, eating and drinking should be prohibited in the application area. Observe precautions pertaining to confined space entry. Equipment containing this material should be isolated and thoroughly drained, washed and purged prior to maintenance/repair operations. Use good housekeeping practices during use, storage, transfer, and handling. Avoid contact with combustible material (paper, wool, oil). Do not pressurize or expose empty containers to open flame, sparks, or heat. Normal precautions should be maintained in handling hot liquids during the unloading of shipping and storage containers. Avoid contact with water. Use only with adequate ventilation/personal protection. Wash thoroughly after handling. Keep away from all sources of ignition. Wash thoroughly after handling with soap and water. Keep container tightly closed when not in use.

Storage

Electrical installations / working materials must comply with the technological safety standards. Avoid contact with incompatible agents. Keep container tightly closed and properly labeled. Metal containers used to store this material should be grounded. Selfheating leading to auto ignition at the surfaces of porous or fibrous materials impregnated with oils or bitumens, can occur at temperatures as low as 100°C. Oil and bitumen contamination of thermal insulation materials and the accumulation of oily rags or similar material near hot surfaces, should therefore be avoided, and lagging should be replaced where necessary by a nonabsorbent type of insulation.

Deposits (carbonaceous materials and iron sulphides) can develop on the internal walls and roofs of tanks in case of long term storage.

Recommended materials: For containers, or container linings use mild steel, stainless steel. All hazard precautions also apply to empty containers. Storage area layout, tank design, equipment and operating procedures must comply with the relevant European, national or local legislation. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Keep container tightly closed and properly labeled. Store away from heat, sparks, open flame and strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. The type of respiratory protection will depend upon whether the maximum exposure concentration is known.

Skin

Wear chemical resistant gloves such as: PVC Neoprene. Nitrile. Vinyl or Butyl rubber. If handling hot material, wear thermal resistant gloves. Skin should be washed after contact. Fire retardant clothing is appropriate for routine occupational use. Use PPE that is chemical resistant to the product and prevents skin contact. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn.

Eyes

Safety glasses with perforated sides. Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Hydrogen sulfide	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	20 ppm	None.
	NIOSH	IDLH	100 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: viscous liquid dark brown, to, black Red Brown to Black.

Odor: Slightly burnt odor. Hydrocarbon. Asphaltic odor. Hydrogen sulfide; rotten eggs.

Odor Threshold: No value available.

pH: not applicable

Boiling point/boiling range: No Data Available.

Melting point/freezing point: no data available

Flash point: > 70 °C (> 158 °F)

Autoignition temperature: 400 °C (752 °F)

Flammability: OSHA/NFPA Class IIIA Combustible Liquid.

Lower explosion limit: no data available

Upper explosion limit: no data available

Explosive properties: Not explosive (No chemical groups associated with explosive properties.)

Oxidizing properties: Not considered an oxidizing agent.

Vapor pressure: No Data Available.

Evaporation rate: Specific data not available.

Relative density: 0.925 - 1.07 @ 15 °C (59 °F) (Based on Vacuum Residues)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Viscosity: 500 - 2,000 mm²/s @ 37.77 °C (99.99 °F)

Water solubility: No Data Available.

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: no data available

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

High temperatures and severe oxidizing conditions. Contact with strong acids.

Materials to avoid

Strong acids, bases, and oxidizing agents, such as liquid chlorine and oxygen. Avoid contact with copper and copper containing alloys. Corrosive to some metals. Powdered metals. Metal oxides. Oxidizers.

Hazardous decomposition products

No degradation data available.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

See component summary.

COMPONENT INFORMATION

- *Residues (petroleum) vacuum 64741-56-6*

Acute toxicity

LC50 (Inhl) rat >0.0944 MG/L 4 HOURS

LD50 (Oral) rat > 5000 MG/KG

LD50 (Skin) rabbit > 2,000 MG/KG

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Ingestion

Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Stream expected to be no more than slightly irritating to the skin based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as a skin irritant.

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Repeated dose toxicity

This substance is a low concern to health following prolonged inhalation or dermal exposures.

Reproductive effects

Stream expected not to be toxic to reproduction based on toxicity information for streams having components in common with this stream.

Developmental Toxicity

Stream expected not to be toxic to development based on toxicity information for streams having components in common with this stream.

Genetic Toxicity

This substance is a low concern for genetic toxicity.

Carcinogenicity

Studies in laboratory animals indicate that this substance is not carcinogenic.

- *Heavy catalytic cracked naphtha 64741-54-4*

Acute toxicity

LC50 (Inhl) rat >5.25 MG/L 4 HOURS

LD50 (Oral) rat 5,000 MG/KG

LD50 (Skin) Rabbit. > 2,000 MG/KG

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Inhalation may cause CNS depression. Can cause pulmonary edema if aspirated into lungs.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for components and a stream having components in common with this stream; however, some components are toxic.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Irritation

Skin

Skin irritant. Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant

Eyes

No eye irritation. Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

No reports of sensitization.

Genetic Toxicity

Mutagenic Substance. May cause genetic defects. Stream expected to be mutagenic based on toxicity information for components present in this stream.

Carcinogenicity

May cause cancer. Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream.

- *Clarified oils (petroleum), catalytic cracked 64741-62-4*

Acute toxicity

<u>LC50 (aerosol)</u>	rat	4.1 MG/ ML
<u>LD50 (Oral)</u>	rat	4,320 MG/KG
<u>LD50 (Skin)</u>	rabbit	>2000 MG/KG

Acute effects

Inhalation

Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Ingestion

Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Not a skin irritant. Stream expected to be no more than slightly irritating to the skin based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as a skin irritant

Eyes



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Repeated dose toxicity

May cause damage to organs through prolonged or repeated exposure. Stream expected to be toxic to target organs with repeated exposure based on toxicity information for streams having components in common with this stream. Results of repeated exposure toxicity testing indicate alterations in serum cholesterol and blood urea nitrogen at high dermal doses accompanied by red blood cell, platelet, liver, and thymus effects at lower exposure levels.

Reproductive effects

Stream expected not to be toxic to reproduction based on toxicity information for streams having components in common with this stream.

Developmental Toxicity

Suspected of damaging the unborn child. Stream expected to be toxic to development based on toxicity information for streams having components in common with this stream. Results of developmental toxicity testing indicate alterations in fetal and pup development, which sometimes occurred in the presence of maternal toxicity.

Genetic Toxicity

Not mutagenic. Stream expected to be not mutagenic based on toxicity information for streams having components in common with this stream.

Carcinogenicity

May cause cancer. Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream. Results obtained from the modified Ames test, from mouse skin painting tests and initiation/promotion assay along with chemical (PAH) analysis indicate that Heavy Fuel Oil streams are carcinogenic.

- *Stop Oil, C20+ Hydrocarbons 68476-53-9*

Other information

No data available.

- *Hydrogen sulfide 7783-06-4*

Acute toxicity

LC50 (Inhl) rat 0.701 MG/L 4 HOURS

Acute effects

Inhalation

Inhalation may cause CNS depression. Damages the respiratory system.

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Irritation

Eyes

Eye irritant.

Target Organs

Eye. Lung. Central nervous system effects. Nasal cavity. Respiratory system. Heart

Repeated dose toxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Repeated inhalation exposure of rats and mice to hydrogen sulfide for 90 days produced decreases in body weight gain and feed consumption at 80 ppm (0.11 mg/L), lesions in the nasal tract and (in rats) lung at \geq 30 ppm (0.04mg/L). Nasal lesions were also observed when rats were exposed to \geq 30 ppm for 10 weeks or \geq 80 ppm for 5 days. Decreased performance in neurological tests has been observed in rats exposed by inhalation to \geq 80 ppm hydrogen sulfide for 5 days; however, no neuropathologic findings were noted when rats and mice were exposed to 80 ppm for 90 days. Rabbits exposed half an hour per day for 5 days to 72 ppm (0.10 mg/L) experienced cardiac arrhythmia.

Reproductive effects

No significant alterations in reproductive performance were observed in rats exposed to 80 ppm (0.111 mg/L) hydrogen sulfide in an inhalation screening study. No treatment-related histopathological changes were found in reproductive organs of rats or mice exposed to up to 80 ppm for 90 days. No adverse effect on spermatogenesis was found when male rats were exposed to 220 ppm (0.306 mg/L) for 7 days, then mated with unexposed virgin females.

Developmental Toxicity

No signs of developmental toxicity, including effects on neurobehavioral performance, were seen in a well-conducted rat inhalation reproduction/developmental toxicity screening study at up to 80 ppm (0.111 mg/L); and no evidence of developmental toxicity was seen in three other studies in which rats were exposed to hydrogen sulfide during gestation at concentrations up to 220 ppm (0.306 mg/L). However, neuro-developmental toxicity studies with offspring of rats exposed to hydrogen sulfide during the gestation and lactation periods have found some alterations that are suggestive of neurotoxicity (e.g., alterations in cerebellar Purkinje cell growth and developmental neurochemical effects) after exposure to 20 ppm (0.028 mg/L). The toxicological significance of these findings in the absence of alterations in neurobehavioral performance is not known.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

See component summary.

Environmental fate and pathways

See component summary.

COMPONENT INFORMATION

- *Residues (petroleum) vacuum* 64741-56-6

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Zebra Fish. 48 mg/l

Acute toxicity to aquatic invertebrates

LL50 / 48 HOURS Daphnia magna (Water flea)

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Toxicity to aquatic plants

EL50 / 72 HOURS Pseudokirchneriella subcapitata (green algae) > 1,000 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Chronic toxicity to fish

LL50 / 28 d Oncorhynchus mykiss (rainbow trout) > 1,000 mg/l

NOEL / 28 d Oncorhynchus mykiss (rainbow trout) >= 1,000 mg/l

Chronic toxicity to aquatic invertebrates

NOEL / 21 d Daphnia magna (Water flea) >= 1,000 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Environmental fate and pathways

Persistence and degradability

Biodegradation: Direct photolysis, hydrolysis, bioaccumulation, adsorption and biodegradation are not expected to be important fate processes in soil or aquatic ecosystems. Not expected to undergo hydrolysis.

Bioaccumulation: Consideration of representative hydrocarbon structures indicated none are likely to be highly bioaccumulative.

- *Heavy catalytic cracked naphtha 64741-54-4*

Ecotoxicity

Acute Fish toxicity

LL50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 10 mg/l

LL50 / 96 HOURS Pimephales promelas (fathead minnow) 8.2 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS Daphnia magna (Water flea) 4.5 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS Pseudokirchneriella subcapitata (green algae) 3.1 mg/l

NOELR / 72 HOURS Pseudokirchneriella subcapitata (green algae) 0.5 mg/l

Toxicity to microorganisms

EC50 / 40 HOURS Tetrahymena pyriformis (ciliated protozoa) 15.41 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOELR / 2.6 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to aquatic invertebrates

NOELR / 21 d Daphnia magna (Water flea) 2.6 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Not expected to be hydrolytically unstable. Not expected to be biodegradable.

Bioaccumulation: Consideration of representative hydrocarbon structures indicated none are likely to be highly bioaccumulative.

- *Clarified oils (petroleum), catalytic cracked 64741-62-4*

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Acute Fish toxicity

LC50 / 96 HOURS Brachydanio rerio 48 mg/l

Environmental fate and pathways

- *Slop Oil, C20+ Hydrocarbons* 68476-53-9

Ecotoxicity

No data available.

Environmental fate and pathways

no data available

- *Hydrogen sulfide* 7783-06-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Lepomis macrochirus 0.0448 mg/l (flow-through)

LC50 / 96 HOURS Pimephales promelas 0.016 mg/l (flow-through)

Acute toxicity to aquatic invertebrates

EC50 / 96 HOURS Gammarus pseudolimnaeus 0.022 mg/l

Other adverse effects

No Data Available.

Environmental fate and pathways

When released into the environment, this material will volatilize rapidly. This material is not expected to persist in the environment.

Persistence and degradability

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

The product should not be allowed to enter drains, water courses or the soil. Contaminated product, soil, water, container residues and spill cleanup materials may be hazardous wastes. Dispose of as hazardous waste in compliance with local and national regulations. Recycle if possible. Can be incinerated, when in compliance with local regulations.

14. TRANSPORT INFORMATION

Proper shipping name Combustible liquid, n.o.s. (Heavy Vacuum Gas Oil)

ID No. NA1993



MATERIAL SAFETY DATA SHEET

MSDS No.: BE92
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 09/20/2011

COKER FEED

Hazard class Combustible Liquid
Packing group III

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Hydrogen sulfide	500lbs	100 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.

SARA 313

This product contains no known chemicals regulated under SARA 313.

State Reporting

This product contains no known chemicals regulated by California's Proposition 65.

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

7783-06-4 Hydrogen sulfide

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

7783-06-4 Hydrogen sulfide

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

7783-06-4 Hydrogen sulfide

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. September 2011

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE92
Variant: U.S.A.-EN
Revision: 1.0
Validation Date: 09/20/2011

COKER FEED

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet

HoustonRefining

A Lyondell Company

Isobutane - Refinery Grade

Material Safety Data Sheet

Company

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston, Texas 77252-2583

MSDS No. AP0827**Revision Date** 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquid		
Color	Colorless liquid, invisible vapor.	Odor	Faint, unpleasant, hydrocarbon.

DANGER! Extremely flammable compressed gas/liquid;
 vapor may cause flash fire or explosion!
 High pressure and rapid diffusion hazard!
 High concentrations of vapor reduce oxygen available for
 breathing and may cause central nervous system
 (CNS) depression or suffocation!
 Prolonged and/or repeated inhalation may increase the
 heart's susceptibility to arrhythmias (irregular beats)!
 Liquid or compressed gas contact may cause frostbite
 or freeze burns!

Hazard Rankings

	HMIS	NFPA
Health Hazard	2	1
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
 See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Isobutane - Refinery Grade
Product Number	2096620966
CAS Number	68476-40-4
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)
Synonyms	Refinery-grade Isobutane; 2-Methylpropane; Trimethylmethane, IC4, Isobutane/n-Butane/Propane Mix C3-C4 Alkane Hydrocarbons.

Business Contact

Product Safety 800-700-0946

24 Hour Emergency Contact

CHEMTREC : 800-424-9300
 CANUTEC-Canada 613-996-6666
 LYONDELL 800-245-4532

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) C3-C4 Hydrocarbons	68476-40-4	100
2) Iso-Butane	75-28-5	75-95
3) N-Butane	106-97-8	4-15
4) Propane	74-98-6	1-10

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact. Eye contact.

Signs and Symptoms of Acute Exposure

Isobutane - Refinery Grade

Inhalation	This gas' vapors can displace the amount of oxygen in air available to breathe below that necessary to sustain life, especially if working in confined spaces. Breathing vapors may also irritate the respiratory tract and cause central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, blurred vision, memory loss, drowsiness, fatigue, rapid or difficult breathing, confusion, vertigo, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure.
Eye Contact	This gas is non-irritating; however, direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns.
Ingestion	Ingestion is not an applicable route of exposure for gases.
Chronic Health Effects Summary	Chronic inhalation to components of this gas (propane and n-butane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of Epinephrine (Adrenaline)-like drugs.
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, or cardiovascular conditions should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this gas.
Target Organs	The substance is toxic to heart, skin, eyes, central nervous system (CNS).
Carcinogenic Potential	This product does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. Irrigate the eyes with copious amounts of clean, low-pressure, room-temperature water. Do not use hot water! Do not use eye ointment unless directed to by a physician. Seek medical attention if excessive tearing, irritation, or pain persists.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. This material may make the heart more susceptible to arrhythmias. Catecholamines and other sympathomimetic drugs should be reserved for emergency situations and then used only with special precaution.

Isobutane - Refinery Grade

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas		
Flash Point/Method	CLOSED CUP AP -83°C (-118°F) (Estimated)		
Lower Flammable Limit	AP 1.8 %	Upper Flammable Limit	AP 8.4 %
Auto-Ignition Temp.	AP 405°C (761°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, unburned hydrocarbon vapors, and trace oxides of sulfur.		
Special Properties	This gas is flammable at well below ambient temperatures and readily forms flammable mixtures with air. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area upwind. Remove all potential ignition sources. Safety stop the source gas flow using non-sparking tools. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Closed gas systems form white-colored frost at the point of a leak. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Water spray may be used to reduce vapors. Avoid entering a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling This gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

Isobutane - Refinery Grade

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed.

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. Safety glasses equipped with side shields or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.

Body Protection

Prevent potential skin contact with cold liquid, solid, or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.

Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this gas mixture may cause atmospheres, some oxygen-deficient (LT 21 Vol.% in air), which can have flammable/explosive potential. DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

- 1) Liquefied Petroleum Gases
- 2) Propane
- 3) Butanes

TWA: 1000 (ppm) from ACGIH (TLV) [1998]
 TWA: 1000 (ppm) from OSHA (PEL) [1989]
 TWA: 2500 (ppm) from ACGIH (TLV) [1998]
 TWA: 1000 (ppm) from OSHA (PEL) [1989]
 TWA: 800 (ppm) from ACGIH (TLV) [1998]
 TWA: 800 (ppm) from OSHA (PEL) [1989]

Isobutane - Refinery Grade

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquid	Color	Colorless liquid; invisible vapor	Odor	Faint, unpleasant, hydrocarbon
Specific Gravity	AP 0.57 (Water = 1)	pH	Not applicable.	Vapor Density	AP 2.0 (Air = 1)
Boiling Point/Range	AP -48° to -9°C (-55° to 15°F) at 14.7 psia (ASTM D-2887)			Melting/Freezing Point	AP -160° to -137°C (-255° to -215°F) at 14.7 psia
Vapor Pressure	AP 50 to 75 psia at 40°C (104°F)			Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Slightly soluble in cold water.			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 21,250 Btu/lb or 3,350 Btu/cu ft., Dry Point Temperature = AP 31°F (-1°C) (ASTM D-86).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Iso-Butane: GAS (TCLo): Acute 1,040 gm/m ³ for 2 hours [Mouse] - Excitement. GAS (LC50): Acute 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress
	n-Butane: GAS (LC50): Acute: 660 gm/m ³ for 4 hour(s) [Rat] GAS (LC50): Acute: 680 gm/m ³ for 2 hours [Mouse].

Liquefied Petroleum Gases: When a 4-hour rabbit inhalation screen test was run on a liquefied petroleum gas, no deaths occurred; however, the animal's heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline)

Butanes: Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of isobutane and n-butane for periods of 8 hours daily for 10 days to 14 days, respectively. Chronic inhalation of high concentrations of isobutane may cause liver and/or kidney damage

An n-Butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to both butane and butylene (additive effect), than the degree of narcosis exhibited following exposure to either gas alone

Propane: Exposure to 1,000 ppm of propane for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs.

Isobutane - Refinery Grade

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage.

Environmental Fate Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%); and therefore, this material will not cause harm to aquatic life. These liquefied gas mixtures will normally evaporate rapidly if spilled. At ambient temperatures and pressure, the components of this gas may contribute to generation of atmospheric smog in a limited manner.

The atmospheric half-lives of propane and the butanes under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of propane, isobutane, and n-butane in air (LT 8%) are not considered environmentally significant.

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material		
Proper Shipping Name	Petroleum gases, liquefied (or Isobutane)		
Hazard Class	CLASS 2.1. Flammable gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1075 (or UN1969)
Reportable Quantity	A Reportable Quantity (RQ) has not been established for any components of this material		
Placards		Emergency Response Guide No.	115
		HAZMAT STCC No.	49 057 50
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.

SARA 302/304 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

SARA 311/312 The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:
Fire, Sudden Release of Pressure, and Acute (Immediate) Health Hazards.

HoustonRefining

A Lyondell Company

Isobutane - Refinery Grade

SARA 313	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: No components were identified.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This product or refinery stream is not known to contain chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) requires warning be given for ingredients known to the State of California to cause cancer, birth defects, or other reproductive toxicity. This product does not contain any known chemical substances subject to this statute.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this product which are subject to this statute are: Propane, Isobutane (Propane, 2-methyl), and Butane

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION	Logo and Manufacturer name change.
Version Number	12.1
Revision Date	11/01/06

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



MATERIAL SAFETY DATA SHEET

NORMAL BUTANE

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

APO828

HFR# 2,4,1

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: NORMAL BUTANE

Number: 00000000000016072

Chemical characterization: Butanes

CAS-No.: 68783-66-4

Chemical Name: n-Butane (Butanes mixture)

Synonyms: N-Butane Product; NC4 Product; BRU Product; Sphere 430 Product; Sweetened LPG or LP-Gas; Butane LPG; Refined LPG, Caustic-washed C4/C5 Olefin /Alkane Hydrocarbon Mix, Refinery-grade, Low-Sulfur, Butane-rich, Liquefied C4/C5 Mixture.

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

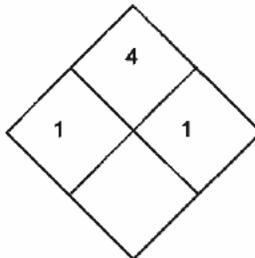
Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

Hazards

Extremely flammable gas. Vapor may cause flash fire or explosion. High Pressure and rapid diffusion hazard. May cause frostbite or freeze burns. CNS depressant. Simple asphyxiant. Possible cardiac Sensitizer. Stream Components have been shown to cause reproductive and developmental toxicity in laboratory animals following repeated inhalation exposure. This stream contains genotoxic and carcinogenic components.

NFPA®



HMIS®

Health	*	2
Flammability		4
Physical Hazard		1

Physical state
 gaseous

Color
 Colorless.

Odor
 Unpleasant.



MATERIAL SAFETY DATA SHEET

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 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Odor Threshold

No Data Available.

Potential health effects

Routes of exposure

Inhalation. Skin. Eye.

Acute effects

See components summary.

- *Propane 74-98-6*

Inhalation of very high concentrations may cause asphyxia, anesthesia, CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe overexposure), and possible cardiac sensitization.

- *Isobutane 75-28-5*

CNS depressant. Can cause cryogenic burns to eyes and skin. Simple asphyxiant.

- *n-Butane 106-97-8*

Simple asphyxiant. Inhalation of vapors may cause dizziness, narcosis, nausea or asphyxiation. CNS depressant.

- *1-Butene 106-98-9*

CNS depressant. Simple asphyxiant. Contact with liquid may cause frostbite.

- *Isobutylene 115-11-7*

Simple asphyxiant, high concentrations can displace oxygen and cause drowsiness and dizziness. Liquid contact may cause cryogenic burns (frostbite).

- *1,3-Butadiene 106-99-0*

May be irritating to the eyes, skin, and respiratory system. CNS depressant.

- *Isopentane 78-78-4*

This product may cause eye, skin, and respiratory tract irritation. High concentrations may cause central nervous system (CNS) depression. Ingestion would likely cause gastrointestinal tract irritation.

- *n-Pentane 109-66-0*

Aspiration hazard. May cause central nervous system depression.

- *Trans-butene-2 624-64-6*

Simple asphyxiant. Contact with liquid may cause frostbite.

- *2-Butene 107-01-7*

CNS depressant. Simple asphyxiant. Contact with liquid may cause frostbite.

- *Hydrogen sulfide 7783-06-4*

Hydrogen sulfide is a highly toxic gas that can be fatal in certain concentrations. Skin absorption hazard. Respiratory tract irritant. Inhalation may cause asthma-like symptoms, including coughing, wheezing, tightness of chest, shortness of breath, and headache. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), with severe shortness of breath. CNS depressant.

- *Methyl Mercaptan 74-93-1*

CNS depressant. May be irritating to the eyes.

- *Ethyl Mercaptan 75-08-1*

Harmful if swallowed.

- *Dimethyl Disulfide 624-92-0*

Respiratory tract irritant. CNS depressant.

- *Carbon Disulfide 75-15-0*

Can be fatal if large amounts are inhaled or ingested.

Skin

Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

Inhalation

Inhalation of vapors may cause respiratory distress and CNS effects. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending on upon level of exposure concentration and/or duration.

Eyes

This gas is non-irritating; but direct contact with liquified/pressurized gas or frost particles may produce severe and possibly permanent eye damage from freeze burns.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Ingestion

Not a route of exposure for a gas.

Chronic effects

Repeated exposure, reproductive and developmental, genotoxic, and cancer hazard. See chapter 11. Toxicological information

- *Propane 74-98-6*

No reports of human health hazards were found.

- *Isobutane 75-28-5*

Reproductive and developmental effects were present in test animals.

- *n-Butane 106-97-8*

Repeated or prolonged exposure to low levels of this material produces no known adverse chronic health hazards.

- *1-Butene 106-98-9*

No adverse chronic human health effects have been reported for this material.

- *Isobutylene 115-11-7*

Component(s) caused cancer and/or birth defects in lab animals.

- *1,3-Butadiene 106-99-0*

Known human carcinogen. Reproductive and developmental effects were present in test animals.

- *Isopentane 78-78-4*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. This substance is a developmental toxicant.

- *n-Pentane 109-66-0*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin.

- *Trans-butene-2 624-64-6*

No known chronic health effects.

- *2-Butene 107-01-7*

Repeated exposures of rats for ~6 wk to 2500 and 5000 ppm (5.7 and 11.5 mg/L) 2-butene (cis and trans) caused reduced bodyweight parameters but no evidence of organ toxicity.

- *Hydrogen sulfide 7783-06-4*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression.

Repeated exposure may cause eye damage with possible loss of vision.

- *Methyl Mercaptan 74-93-1*

Component caused a decrease in body weight gain in lab animals.

- *Ethyl Mercaptan 75-08-1*

May cause nausea. Repeated or prolonged exposure may irritate the mucous membranes.

- *Dimethyl Disulfide 624-92-0*

Component caused a decrease in body weight gain in lab animals.

- *Carbon Disulfide 75-15-0*

Central nervous system effects.

Aggravated Medical Condition

Personnel with pre-existing chronic respiratory diseases should avoid exposure to this material. This material may aggravate existing cardiovascular disease or function. Persons with chronic respiratory disease may be at increased risk.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Vol-%</u>
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MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Propane	74-98-6	200-827-9	0.0	<= 5.0
Isobutane	75-28-5	200-857-2	0.0	<= 44.0
n-Butane	106-97-8	203-448-7	6.0	<= 100.0
1-Butene	106-98-9	203-449-2	0.0	<= 15.0
Isobutylene	115-11-7	204-066-3	0.0	<= 17.0
1,3-Butadiene	106-99-0	203-450-8	0.0	<= 0.5
Isopentane	78-78-4	201-142-8	0.0	<= 3.0
n-Pentane	109-66-0	203-692-4	0.0	<= 1.0
Trans-butene-2	624-64-6	210-855-3	0.0	<= 16.0
2-Butene	107-01-7	203-452-9	0.0	<= 10.0
Hydrogen sulfide	7783-06-4	231-977-3		< 0.1
Methyl Mercaptan	74-93-1	200-822-1		< 0.1
Ethyl Mercaptan	75-08-1	200-837-3		< 0.1
Dimethyl sulfide	75-18-3	200-846-2		< 0.1
Dimethyl Disulfide	624-92-0	210-871-0		< 0.1
Carbon Disulfide	75-15-0	200-843-6		< 0.1

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

The affected frozen tissue area should be placed in a warm water bath, with temperatures at or below 40C. DO NOT use: Dry Heat or Hot water. Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if discomfort persists.

Inhalation

Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

Check for and remove contact lenses. For contact with cold liquid or gas. Flush eyes with directed stream of lukewarm water for at least 15 minutes. GET MEDICAL ATTENTION IMMEDIATELY.

Ingestion

Ingestion unlikely.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Notes to physician
 Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

Extremely flammable gas.

Flash point

~ -60 °C (-76 °F) closed cup (Based on Butane)

Autoignition temperature

~ 287 °C (548.6 °F) (Based on Butane)

Lower explosion limit

1.9 vol% (Based on Butane)

Upper explosion limit

8.5 vol% (Based on Butane)

Extinguishing Media

Suitable extinguishing media

LARGE FIRE: Use waterspray, water fog or foam. DO NOT use straight streams SMALL FIRE: Use dry chemicals, CO2

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.

Precautions for fire-fighting

DO NOT extinguish a leaking gas fire unless leak can be stopped. Fires involving this material should not be extinguished unless the source flow can be stopped immediately. Shut off the source and allow the fire to burn itself out. If it can not be shut off immediately, all exposed equipment and surfaces must be cooled with water to prevent over-heating, flash backs, or explosions. Control fire until source can be shut off. Potential explosion hazard from reignition, if fire is put out without shutting off source. Releases flammable vapors below normal ambient temperatures. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Extremely flammable gas. Release causes immediate fire/explosion hazard. Evacuate all non-essential personnel to an area upwind (at least 1/2 mile in all directions if tanks or tank cars are involved in fire or spill). Stop source of release with non-sparking tools before beginning clean-up or fire extinguishing. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Closed systems form white frost at the point of leak. Do not direct water at spill or source of leak. Eliminate all sources of ignition. Let evaporate. If possible, turn leaking container so that gas escapes rather than liquid. Do not direct water at spill or source. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas. Caution: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Liquid spills will vaporize forming cold dense vapor clouds that do not readily disperse. Avoid vapor cloud even with proper respiratory equipment. Contain spill with dike to prevent entry into sewers or waterways.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

7. HANDLING AND STORAGE

Handling

Odor is not an adequate warning of potentially hazardous ambient air concentrations. Releases of these gases may cause atmospheres, some oxygen deficient, which can have flammable/explosive potential. Do not enter such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. During transfer of product, ground container and insure that all conveying equipment is properly grounded. Consult the U.S. National Fire Protection Association standard for the storage and handling of liquified petroleum gases (NFPA No. 58) for additional recommendations.

Storage

Store in tightly closed/properly vented containers away from ignition sources, reducing agents, foreign metals, strong acids, or water. Keep containers tightly closed and in a well-ventilated place. Store away from oxidizers and other combustible material by a distance of at least 20 feet. Keep container tightly closed and properly labeled. Securely chain cylinders when in use and protect against physical damage. Store below 100°F (38°C). Protect from dampness, salt or corrosive materials. Store and transport in an upright container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal protective equipment

Inhalation

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Skin

Use chemical resistant gloves appropriate to conditions of use. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use.

Eyes

Wear safety glasses as minimum eye protection. Conditions may warrant the use of chemical goggles and possibly a face shield. Consult your standard operating procedure or safety professional for advice. Use protective eye and face devices that comply with ANSI Z87.1-1987.

Remarks

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Propane	US (ACGIH)	TWA	1,000 ppm	None.
	US (OSHA)	TWA	1,000 ppm 1,800 mg/m ³	None.
	NIOSH	IDLH	2,100 ppm	None.
Isobutane	US (ACGIH)	TWA	1,000 ppm	None.
n-Butane	US (ACGIH)	TWA	1,000 ppm	None.
1-Butene	US (ACGIH)	TWA	250 ppm	None.
	US (ACGIH)	TWA	250 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
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 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Isobutylene	US (ACGIH)	TWA	250 ppm	None.
1,3-Butadiene	US (ACGIH)	TWA	2 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
	NIOSH	IDLH	2,000 ppm	None.
Isopentane	US (ACGIH)	TWA	600 ppm	None.
n-Pentane	US (ACGIH)	TWA	600 ppm	None.
	US (OSHA)	TWA	1,000 ppm 2,950 mg/m3	None.
	NIOSH	IDLH	1,500 ppm	None.
Trans-butene-2	US (ACGIH)	TWA	250 ppm	None.
2-Butene	US (ACGIH)	TWA	250 ppm	None.
Hydrogen sulfide	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	20 ppm	None.
	NIOSH	IDLH	100 ppm	None.
Methyl Mercaptan	US (ACGIH)	TWA	0.5 ppm	None.
	US (OSHA)	CEILING	10 ppm 20 mg/m3	None.
	NIOSH	IDLH	150 ppm	None.
Ethyl Mercaptan	US (ACGIH)	TWA	0.5 ppm	None.
	US (OSHA)	CEILING	10 ppm 25 mg/m3	None.
	NIOSH	IDLH	500 ppm	None.
Dimethyl sulfide	US (ACGIH)	TWA	10 ppm	None.
Dimethyl Disulfide	US (ACGIH)	TWA	0.5 ppm	None.
Carbon Disulfide	US (ACGIH)	TWA	1 ppm	None.
	98/24/EC	Peak	100 ppm	None.
	US (OSHA)	CEILING	30 ppm	None.
	US (OSHA)	TWA	20 ppm	None.
	NIOSH	IDLH	500 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
Variant: U.S.A.-EN
Revision: 1.1
Validation Date: 11/05/2010

NORMAL BUTANE

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: gaseous Colorless.

Odor: Unpleasant.

Odor Threshold: No Data Available.

pH: Not applicable.

Boiling point/boiling range: -1 °C (30.2 °F)(Based on Butane)

Melting/freezing point: ~ -138 °C (-216.4 °F) (Based on Butane)

Flash point: ~ -60 °C (-76 °F) closed cup (Based on Butane)

Autoignition temperature: ~ 287 °C (548.6 °F) (Based on Butane)

Flammability: Extremely flammable gas.

Lower explosion limit: 1.9 vol% (Based on Butane)

Upper explosion limit: 8.5 vol% (Based on Butane)

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: ~ 220 kPa (Based on Butane)

Evaporation rate: Very high.

Relative density: No Data Available.

Relative vapor density: 2.11 (Air = 1.0) (Based on Butane)

Viscosity: Not applicable.

Water solubility: Slightly soluble in cold water.

Partition coefficient: n-octanol/water: Specific data not available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-BN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Other physico-chemical properties: Low boiling point intensifies pressure and rapid diffusion hazard.

10. STABILITY AND REACTIVITY

Chemical stability

This product is stable when properly stored and is not expected to polymerize.

Conditions to avoid

Heat, sparks, open flames and strong oxidizing conditions.

Materials to avoid

Strong acids, bases, and oxidizing agents, such as liquid chlorine and oxygen. Halogens (bromine, chlorine, fluorine). Peroxides. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.

Hazardous decomposition products

Carbon Monoxide and Carbon dioxide. When heated to decomposition it emits acrid smoke and fumes. Unburned hydrocarbons.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Data for components are used as surrogate data for the health characterization of this product. Inhalation of very high concentrations of the Product may cause asphyxia, anesthesia, CNS stimulation followed by CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure), and possible cardiac sensitization. If hydrogen sulfide is present, other neurological effects and respiratory tract irritation and/or damage may also be produced. Exposure to methyl or ethyl mercaptans, dimethyl sulfide, dimethyl disulfide or carbon disulfide, if present, may also cause irritation of mucous membranes. Dangerous levels of hydrogen sulfide and methyl or ethyl mercaptan may not be detected by odor. Exposure to acetonitrile, if present, may also cause difficult or painful breathing, lung damage, respiratory tract irritation and corneal opacity. Very little of this Product is likely to be absorbed through the skin. Skin or eye irritation is not likely, but evaporating liquid might cause frost injuries. Skin sensitization is not expected. Available animal data for components of the stream demonstrate repeated exposure toxicity by the inhalation route of exposure, with species differences in affected target organ toxicity. Stream Components have been shown to cause reproductive and developmental toxicity in laboratory animals following repeated inhalation exposure. This stream contains genotoxic and carcinogenic components.

Acute toxicity

<u>LC50 (Inhl).</u> <u>(predicted:</u> <u>mixture of cis-</u> <u>and trans-2-</u> <u>butene)</u>	rat	23 MG/L (10,000 PPM)	4 HOURS
<u>LC50 (vapor).</u> <u>Based on</u> <u>isopentane.</u> <u>(predicted)</u>	mouse	413 MG/L (140,000 PPM)	2 HOURS

Acute effects

Inhalation

Stream expected to have a low order of acute inhalation toxicity based on toxicity information for components present at > 1%; however, stream occasionally contains hydrogen sulfide, methyl mercaptan, ethyl mercaptan, carbon disulfide and/or acetonitrile at levels that may be dangerous to life and health (i.e., greater than 100 ppm, 150 ppm, 500 ppm, 500 ppm and 500 ppm respectively); and may contain dimethyl sulfide at levels causing 50% lethality in rats and mice (805 ppm and 500



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

ppm, respectively).

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Irritation

Skin

None expected. Evaporating liquid may cause frost bite.

Eyes

None expected. Evaporating liquid may cause frost bite.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

See component summary.

Repeated dose toxicity

May be toxic following repeated inhalation exposure to very high concentrations. Repeated inhalation exposure of rats to a stream containing components in common with this product, at 10,000 ppm for 13 weeks produced no treatment-related general systemic effects; however, available animal data for components of the product demonstrate repeated exposure toxicity with species differences in affected target organs. The stream components demonstrating significant toxicity following repeated inhalation exposures are propane, isobutylene, 2-butene, hydrogen sulfide, methyl mercaptan, ethyl mercaptan, dimethyl sulfide, carbon disulfide and acetonitrile; and their reported toxicological effects include: decreased body weight/weight gain; effects on the nasal tract, forestomach, cardiovascular system, hematopoietic and nervous systems, lung, adrenal gland, thymus, liver, spleen and kidney; changes in clinical chemistry parameters; nausea; irritation of mucous membranes; ocular effects; and a rise in olfactory threshold.

Reproductive effects

May cause reproductive toxicity. In a 13-week inhalation toxicity study conducted in rats, a stream having components in common with this stream produced no effects on reproductive organ weight or pathology; estrus cycle; or sperm count, motility or morphology. Available information from studies conducted in laboratory animals with most components of this stream (n-butane, propane, propylene, 1-butene, isobutylene, 2-butene, n-pentane, ethane, cyclopentane, 2-methyl-2-butene) shows no evidence of an effect on reproductive performance or reproductive organs at high inhalation doses. The component hydrogen sulfide produced no evidence of reproductive toxicity at 80 ppm (0.111 mg/L). Other minor components (dimethyl sulfide, dimethyl disulfide, acetonitrile) produced no effects on reproductive organs in rats and/or mice after repeated oral or inhalation exposures. Three components (isobutane, 1,3-butadiene and carbon disulfide) have demonstrated possible reproductive toxicity. These effects included an increase in post-implantation loss, testicular and ovarian atrophy, and changes in sperm head morphology and in humans, possible changes in male reproductive function.

Developmental Toxicity

May be toxic to the developing embryo/fetus. No signs of developmental toxicity were seen in rats in an inhalation developmental toxicity study conducted with a stream having components in common with this stream. Available information from studies conducted in laboratory animals at high inhalation doses with most components of this stream (propane, propylene, n-butane, 1-butene, isobutylene, 2-butene, n-pentane, ethane, 2-methyl-2-butene) shows no evidence of developmental toxicity. Some components (isobutane, 1,3-butadiene, hydrogen sulfide, dimethyl disulfide and carbon disulfide) have demonstrated possible developmental toxicity. These effects included decreased fetal weight and pup viability and increased pre- and post-implantation loss, retarded development, alterations in cerebellar Purkinje cell growth, developmental neurochemical effects, and skeletal and visceral malformations.

Genetic Toxicity

May be genotoxic. A stream with components in common with this stream was negative in a micronucleus assay in rats exposed by inhalation. Most components of normal-Butane have produced negative results in a variety of in vitro and in vivo genotoxicity studies; however, two stream components (2-methyl-2-butene and 1,3-butadiene) have caused gene mutation and/or chromosome damage in rats and/or mice after inhalation exposure, and another component (cyclopentane) was positive in an in vitro chromosome aberrations assay but negative in an in vivo micronucleus assay. Studies to assess genetic damage in humans exposed to the stream component 1,3-butadiene have returned inconsistent or equivocal results. Acetonitrile (a component present at <= 1200 ppm) showed weak clastogenic activity in cultured mammalian cells



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-BN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Developmental Toxicity

and in a mouse bone marrow micronucleus test; however, negative results were obtained in two other micronucleus tests. Acetonitrile induced aneuploidy in yeast and oocytes of fruit flies.

Carcinogenicity

This product contains carcinogenic components. Cancer data for components are used as surrogate data for this product.

COMPONENT INFORMATION

- *Propane* 74-98-6

Acute toxicity

LC50 (vapor) rat >1443 MG/L 0.25 HOURS

Acute effects

Inhalation

Inhalation of very high concentrations may cause asphyxia, anesthesia, CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe overexposure), and possible cardiac sensitization.

Ingestion

Propane is a compressed gas; hence oral exposure and resulting acute toxicity are unlikely.

Skin contact

Evaporating liquid might cause frost injuries. Very little propane is likely to be absorbed through the skin.

Irritation

Skin

Propane is not likely to cause skin irritation, but evaporating liquid might cause frost injuries.

Eyes

There is no evidence to suggest this material may cause eye irritation. Liquid contact may cause cryogenic burns (frostbite).

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

CNS depressant. Cardiac sensitization. Eye. Skin.

Repeated dose toxicity

Repeated inhalation exposures of rats for 4-6 weeks to 12,000 ppm (21.64 mg/L) propane caused no general systemic or neurotoxic effects apart from a reduction of body weight/weight gain in males. No adverse effects were noted when human subjects were exposed to 1000 ppm (1.80 mg/L) propane for 2 weeks.

Reproductive effects

No signs of reproductive toxicity were observed in an inhalation screening test of rats exposed up to 12,000 ppm (21.64 mg/L) propane.

Developmental Toxicity

No signs of developmental toxicity were observed in an inhalation screening test of rats exposed to up to 12,000 ppm (21.64 mg/L) propane.

Genetic Toxicity

Propane was negative in an in vitro test for bacterial gene mutation.

Carcinogenicity

No Data Available.

- *Isobutane* 75-28-5



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Acute toxicity

<u>LC50 (Inhl)</u>	mouse	1237 MG/L	2 HOURS
	rat	31 MG/L	4 HOURS

Acute effects

Inhalation

Simple asphyxiant.

Irritation

Skin

Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

Eyes

None expected. Evaporating liquid may cause frost bite.

Target Organs

CNS depressant.

Repeated dose toxicity

No biologically significant treatment-related systemic effects were seen when rats were exposed by inhalation for 4-6 weeks to 9000 ppm (21.4 mg/L) isobutane. No adverse effects were noted when human subjects were exposed to 500 ppm (1.19 mg/L) isobutane for 2 weeks.

Reproductive effects

An exposure-related increase in post-implantation loss, in the absence of parental toxicity, was observed in an inhalation screening test of rats exposed to 9000 ppm (21.39 mg/L) isobutane.

Developmental Toxicity

An exposure-related increase in post-implantation loss, in the absence of parental toxicity, was observed in an inhalation screening test of rats exposed to 9000 ppm (21.39 mg/L) isobutane.

Carcinogenicity

This substance is not classified for carcinogenicity by IARC, OSHA, NTP, or the EPA.

- *n-Butane* 106-97-8

Acute toxicity

<u>LC50 (Inhl)</u>	rat	658 MG/L	4 HOURS
	mouse	680 MG/L	2 HOURS

Acute effects

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Irritation

Skin

None expected. Evaporating liquid may cause frost bite.

Eyes

None expected. Evaporating liquid may cause frost bite.

Target Organs

CNS depressant.

Repeated dose toxicity

No biologically significant treatment-related systemic effects were seen when rats were exposed by inhalation for 4-6 weeks to 9000 ppm (21.4 mg/L) nbutane.

Reproductive effects



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Reproductive effects

No signs of reproductive toxicity were observed in an inhalation screening test of rats exposed to up to 9000 ppm (21.39 mg/L) n-butane.

Developmental Toxicity

No signs of developmental toxicity were observed in an inhalation screening test of rats exposed to up to 9000 ppm (21.39 mg/L) n-butane.

- *1-Butene* 106-98-9

Acute effects

Inhalation

Simple asphyxiant.

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Target Organs

No significant hazards.

Repeated dose toxicity

No biologically significant treatment-related systemic effects were seen when rats were exposed for 4 wk to 8000 ppm (18.4 mg/L) 1-butene.

Reproductive effects

No treatment-related reproductive toxicity was observed in an inhalation screening test of rats exposed to up to 8000 ppm (18.4 mg/L) 1-butene.

Developmental Toxicity

No developmental toxicity or teratogenicity was observed in a screening test of rats exposed to 8000 ppm (18.4 mg/L) 1-butene.

Genetic Toxicity

1-Butene was not genotoxic in tests that evaluated mutations and chromosomal aberrations.

- *Isobutylene* 115-11-7

Acute effects

Ingestion

Isobutylene is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Isobutylene is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Irritation

Skin

Rapid evaporation of the liquid may cause frostbite.

Eyes

Rapid evaporation of the liquid may cause frostbite.

Target Organs

Eye. Skin. Respiratory system. central nervous system (CNS) Cardiac sensitization.

Reproductive effects

No biologically significant effects on male or female reproductive organs/parameters were observed in repeated dose inhalation studies in rats or mice at concentrations up to 8000 ppm (18.4 mg/L).

Developmental Toxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-BN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Developmental Toxicity

No signs of developmental toxicity were observed in a screening inhalation test of rats exposed to up to 8000 ppm (18.4 mg/L) isobutylene.

Genetic Toxicity

Isobutylene was not genotoxic in tests conducted in vitro at concentrations up to 100% and in vivo at concentrations up to 10,000 ppm (22.9 mg/L). Isobutylene is metabolized to 2-methyl-1,2-epoxypropane, a substance shown to be genotoxic in some in vitro tests; however this conversion is of doubtful significance to isobutylene genotoxicity as all the tests of isobutylene are negative.

Carcinogenicity

Isobutylene produced an increase in follicular cell carcinomas of the thyroid in male rats following inhalation exposures to 8000 ppm (18.4 mg/L) for 2 years. Thyroid tumors did not occur in male rats exposed to lower doses, or to female rats or male or female mice.

- *1,3-Butadiene 106-99-0*

Acute toxicity

<u>LC50 (Inhl)</u>	rat	285 MG/L	4 HOURS
	mouse	267 MG/L	4 HOURS

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

There are no known reliable studies regarding toxicity in humans or animals after oral exposures.

Skin contact

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures. There are no known reliable studies regarding sensitization in test animals. However, human experience suggests that it is unlikely to cause allergic skin conditions.

Irritation

Skin

Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite. There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures. There are no known reliable studies regarding sensitization in test animals. However, human experience suggests that it is unlikely to cause allergic skin conditions.

Eyes

Vapor may be irritating to the eye, especially at high concentrations.

Target Organs

Respiratory system. Lymphohematopoietic system. Gonads. Liver. Damages the heart. Central nervous system.

Repeated dose toxicity

Butadiene is highly toxic in the mouse, producing lesions in a range of tissues (including ovary, testis, lung, liver, bone marrow, thymus, forestomach and heart) after repeated inhalation exposure. No comparable changes occurred in rats or other laboratory animal species, hence the relevance of these findings to humans is that it is a known carcinogen.

Reproductive effects

Testicular- and ovarian atrophy, and changes in sperm head morphology, have been reported in mice following repeated exposure to butadiene vapor, however no adverse effects on fertility or reproduction have been reported.

Developmental Toxicity

Results from animal studies demonstrate that butadiene is not a teratogen, however mild fetotoxicity (primarily retarded development) has been observed in rodents exposed to high levels of butadiene vapor during pregnancy. These effects generally occur at exposures that also produce maternal toxicity.

Genetic Toxicity

Butadiene is genotoxic in the mouse, and induces micronuclei, chromosomal aberrations and gene mutations after



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-BN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Developmental Toxicity

Inhalation exposure. Most studies with rats are negative; however, butadiene produced hprt mutations in rats, but at a concentration much higher than that required for mice. Studies to assess genetic damage in exposed worker populations have returned inconsistent or equivocal results.

Carcinogenicity

Animal data demonstrate marked species difference in carcinogenic response to butadiene. In the mouse, long term inhalation exposure is associated with an increased incidence of benign and malignant cancers in a wide range of tissues, whereas a more limited tumor profile is seen in the rat. Epidemiology studies suggest butadiene may be carcinogenic in humans with a concern for cancers of the lymphohematopoietic system. Listed by IARC as "carcinogenic to humans" (Group 1), on the basis of "sufficient evidence" in humans of an increased risk for leukemias. Listed by NTP as known to be a human carcinogen in their Report on Carcinogens, current edition. This listing was based on sufficient evidence of carcinogenicity in humans, including epidemiologic and mechanistic information, to indicate a causal relationship between occupational exposure to 1,3-butadiene and excess mortality from lymphatic and hematopoietic cancers.

- *Isopentane* 78-78-4

Acute toxicity

<u>LC50 (Inhl)</u>	mouse	413 MG/L	2 HOURS
	rat	1281.9 MG/L	4 HOURS

Irritation

Skin

Defatting of the skin with irritation, dryness and cracking.

Eyes

Slight eye irritant.

Target Organs

Skin. Eye.

Repeated dose toxicity

Repeated oral gavage exposures of rats to 500 mg/kg bwt/day isopentane produced lethality and decreases in bodyweight gain.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Pentane* 109-66-0

Acute toxicity

<u>LC50 (Inhl)</u>	rat	> 18.02 MG/L	4 HOURS
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<u>LD50 (Oral)</u>	rat	> 2000 MG/KG BWT
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<u>LD50 (Skin)</u>	rabbit	3000 MG/KG
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Target Organs

Respiratory system. Kidneys.

Repeated dose toxicity

No treatment-related effects were observed in a 90-day inhalation study in rats exposed to n-pentane at up to 6778 ppm (20 mg/L). Inhalation neurotoxicity evaluations in rats exposed to n-pentane at 3000 ppm (8.9 mg/L) for up to 30 weeks found no evidence of neurotoxicity. Repeated oral gavage exposures of rats to 500 mg/kg bwt/day n-pentane produced lethality, decreases in bodyweight gain and slightly lower kidney weights.

Reproductive effects

No effects on reproductive organs were observed in a 90-day inhalation study in rats exposed to n-pentane at ~7000 ppm (20 mg/L). n-Pentane was negative in a dominant lethal test in mice when males were given a single intraperitoneal injection of 48-666 mg/kg bwt.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Developmental Toxicity

No developmental toxicity was observed when pregnant rats were exposed to n-pentane by oral administration of 1000mg/kg bwt/day or by inhalation of 10000 ppm (29.5 mg/L).

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Trans-butene-2* 624-64-6

Acute effects

Skin contact

Considered to be of low toxicity by the dermal route of exposure.

Repeated dose toxicity

No known chronic health effects.

- *2-Butene* 107-01-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	> 23 MG/L (10000 PPM)	4.0 HOURS
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Acute effects

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Repeated dose toxicity

Repeated exposures of rats for ~6 wk to 2500 and 5000 ppm (5.7 and 11.5 mg/L) 2-butene (cis and trans) caused reduced bodyweight parameters but no evidence of organ toxicity.

Reproductive effects

No treatment-related reproductive toxicity was observed in an inhalation screening test of rats exposed to up to 5000 ppm (11.5 mg/L) 2-butene (cis and trans).

Developmental Toxicity

No developmental toxicity or teratogenicity was observed in a screening test of rats exposed to 5000 ppm (11.5 mg/L) 2-butene (cis and trans).

Genetic Toxicity

2-Butene was not genotoxic in tests that evaluated mutations and chromosomal aberrations.

- *Hydrogen sulfide* 7783-06-4

Acute toxicity

<u>LC50 (Inhl)</u>	rat	0.701 MG/L	4 HOURS
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Acute effects

Inhalation

Inhalation may cause CNS depression. Damages the respiratory system.

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Irritation

Eyes

Eye irritant.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Target Organs

Eye. Lung. Central nervous system effects. Nasal cavity. Respiratory system. Heart

Repeated dose toxicity

Repeated inhalation exposure of rats and mice to hydrogen sulfide for 90 days produced decreases in body weight gain and feed consumption at 80 ppm (0.11 mg/L), lesions in the nasal tract and (in rats) lung at $>_{=}$ 30 ppm (0.04mg/L). Nasal lesions were also observed when rats were exposed to $>_{=}$ 30 ppm for 10 weeks or $>_{=}$ 80 ppm for 5 days. Decreased performance in neurological tests has been observed in rats exposed by inhalation to $>_{=}$ 80 ppm hydrogen sulfide for 5 days; however, no neuropathologic findings were noted when rats and mice were exposed to 80 ppm for 90 days. Rabbits exposed half an hour per day for 5 days to 72 ppm (0.10 mg/L) experienced cardiac arrhythmia.

Reproductive effects

No significant alterations in reproductive performance were observed in rats exposed to 80 ppm (0.111 mg/L) hydrogen sulfide in an inhalation screening study. No treatment-related histopathological changes were found in reproductive organs of rats or mice exposed to up to 80 ppm for 90 days. No adverse effect on spermatogenesis was found when male rats were exposed to 220 ppm (0.306 mg/L) for 7 days, then mated with unexposed virgin females.

Developmental Toxicity

No signs of developmental toxicity, including effects on neurobehavioral performance, were seen in a well-conducted rat inhalation reproduction/developmental toxicity screening study at up to 80 ppm (0.111 mg/L); and no evidence of developmental toxicity was seen in three other studies in which rats were exposed to hydrogen sulfide during gestation at concentrations up to 220 ppm (0.306 mg/L). However, neuro-developmental toxicity studies with offspring of rats exposed to hydrogen sulfide during the gestation and lactation periods have found some alterations that are suggestive of neurotoxicity (e.g., alterations in cerebellar Purkinje cell growth and developmental neurochemical effects) after exposure to 20 ppm (0.028 mg/L). The toxicological significance of these findings in the absence of alterations in neurobehavioral performance is not known.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Methyl Mercaptan* 74-93-1

Acute toxicity

<u>LC50 (Inhl)</u>	rat	1.33 MG/L (675 PPM)	4 HOURS
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Acute effects

Inhalation

May cause headaches. Inhalation may cause CNS depression. May cause irritation of the mucous membranes.

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures.

Irritation

Skin

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures.

Eyes

May cause eye irritation.

Target Organs

central nervous system (CNS) Mucous membrane irritant. Respiratory system. Eye irritant.

Repeated dose toxicity

Repeated inhalation exposure of rats for 90 days to 57 ppm (0.11 mg/L) methyl mercaptan produced a decrease in body weight gain.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

- *Ethyl Mercaptan* 75-08-1

Acute toxicity

<u>LC50 (Inhl)</u>	rat	11.23 MG/L (4420 PPM)	4 HOURS
<u>LD50 (Oral)</u>	rat	682 MG/KG BWT	
	rat	>2000 MG/KG BWT	

Acute effects

Inhalation

No human information is available.

Ingestion

Harmful if swallowed.

Skin contact

No human information is available.

Irritation

Skin

No human information is available.

Eyes

No human information is available.

Target Organs

Nasal cavity.

Repeated dose toxicity

In a poorly reported inhalation study, rabbits, rats and mice exposed to ethyl mercaptan for 5 months at 0.10 mg/L (40 ppm), showed minimal deviations in cardiovascular system regulation and organ weights. Human subjects exposed to ethyl mercaptan at 0.010 mg/L (4 ppm) for 3 hr/day during 5-10 days produced a rise in olfactory threshold, nausea, irritation of mucous membranes, and fatigue; while exposure at 0.001 mg/L (0.5 ppm) produced no unpleasant symptoms.

- *Dimethyl sulfide* 75-18-3

Acute toxicity

	rat	102 MG/L (40,250 PPM)	4 HOURS
<u>LD50 (Oral)</u>	mouse	3700 MG/KG	
	rabbit	>5 G/KG BWT	

Acute effects

Inhalation

No human information is available.

Skin contact

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures.

Irritation

Skin

No human information is available.

Eyes



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

No human information is available.

Sensitization

No evidence of skin or respiratory sensitization.

Repeated dose toxicity

Dimethyl sulfide administered orally to rats at 2.5 to 250 mg/kg bwt/day for 14 weeks, produced increases in small intestine weights in males at all dose levels, and an increase in thyroid weight in males and a decrease in thyroid weight in females at 250 mg/kg bwt/day. These organ weight effects were not correlated with histopathological findings.

Reproductive effects

No effects on reproductive organs were observed in a 14-week oral gavage study in rats exposed to dimethyl sulfide at up to 250 mg/kg bwt/day.

Developmental Toxicity

No developmental toxicity was observed when dimethyl sulfide was administered by oral gavage to pregnant rats at 1000 mg/kg bwt/day.

- *Dimethyl Disulfide* 624-92-0

Acute toxicity

<u>LC50 (Inhl)</u>	rat	3.1 MG/L (805 PPM) 4 HOURS
	rat	1.9 MG/L (500 PPM) 4 HOURS
<u>LD50 (Oral)</u>	rat	190 MG/KG BWT
	rabbit	>2000 MG/KG BWT

Acute effects

Inhalation

No human information is available.

Ingestion

No human information is available.

Skin contact

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures.

Target Organs

Nasal cavity. Skin irritant.

Repeated dose toxicity

Rats exposed to dimethyl disulfide by inhalation for 6 hr/day, 5 days/week for 90 days showed decreased body weight gain, changes in clinical chemistry parameters and reversible microscopic changes in the nasal mucosa (> 10 ppm/0.039 mg/L); reduced food consumption (> 25 ppm/0.096 mg/L); decreased thymus weight and increased adrenal gland weight (125 ppm/0.482 mg/L); and marginal changes in hematology parameters (females at 250 ppm/0.96 mg/L); but no evidence of neurotoxicity. Domestic fowl administered dimethyl disulfide orally at total daily doses of 300 µg for 6 days and 600 µg for 6 days, showed signs of neurotoxicity and hemolytic anemia. Dermal exposure of rabbits to dimethyl disulfide on 5 days/week (10.63 and 106.3 mg/kg bwt/day for 4 weeks; and 1063 mg/kg bwt/day for 2 1/2 weeks) produced mortality in the high dose, lethargy in the mid and high doses, differences in some hematology and clinical chemistry parameters in high dose males, and severe, dose-related skin irritation in all dose groups.

Reproductive effects

No effects on reproductive organs were observed in rats following inhalation of dimethyl disulfide for 90 days at concentrations up to 250 ppm (0.96 mg/L).

Developmental Toxicity

In an inhalation developmental toxicity study in rats administered up to 50 ppm (0.193 mg/L) dimethyl disulfide on gestation days 6 to 15, a reduction in fetal weight and an increase in retarded ossification were seen at 50 ppm, in the presence of maternal toxicity (reduced body weight gain), but there was no evidence of teratogenicity.

Genetic Toxicity

Predominantly negative results were obtained with dimethyl disulfide when tested in vitro (negative in assays for bacterial and mammalian cell gene mutation and bacterial DNA damage and repair, ambiguous positive for chromosome aberrations



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Developmental Toxicity

in human lymphocytes). Negative results were obtained when dimethyl disulfide was evaluated in vivo (mouse micronucleus, unscheduled DNA synthesis).

- *Carbon Disulfide 75-15-0*

Acute toxicity

<u>LC50 (Inhl)</u>	rat	25 MG/L (8025 PPM)	2 HOURS
	mouse	10 MG/L (3210 PPM)	2 HOURS

<u>LD50 (Oral)</u>	rat	11400 MG/KG BWT
	mouse	12800 MG/KG BWT

Acute effects

Inhalation

Acute effects may include vertigo, drowsiness, fatigue, blurred vision, headache and/or eye and throat irritation. High concentrations in air may be narcotic and depress the central nervous system (CNS) with symptoms including headache, breathing difficulty, dizziness, drowsiness, loss of coordination, weakness, nausea, and vomiting.

Ingestion

May be harmful if swallowed.

Skin contact

No human information is available.

Irritation

Skin

May produce blisters.

Eyes

Specific data not available.

Sensitization

no data available

Target Organs

Central nervous system effects. Skin.

Repeated dose toxicity

Neurotoxic effects on the central and peripheral nervous systems were consistently observed in rodents following inhalation exposure to carbon disulfide (CS₂) at > 250 ppm (0.8 mg/L). Other effects observed in laboratory animals repeatedly exposed to CS₂ include decreases in body weight gain and changes in hematology parameters at > 300 ppm, hepatotoxicity at > 400 ppm, cardiovascular effects at > 321 ppm (1.0 mg/L), ocular effects at > 256 ppm (0.8 mg/L), and kidney effects in male mice at 800 ppm (2.5 mg/L). Male rabbits exposed to CS₂ at concentrations that increased from 250 ppm (0.8 mg/L) to 750 ppm (2.3 mg/L) over 38 weeks also showed effects on the adrenal gland, spleen, and kidney. The central and peripheral nervous systems appear to be the critical targets for CS₂-induced toxicity in humans. Other effects for which there is considerable weight of evidence in humans exposed to CS₂ by inhalation include alterations in serum lipids and blood pressure that are associated with increased risk of cardiovascular disease, and ocular effects. Specialized oral toxicity studies with rats administered CS₂ showed reductions in body weight (253 mg/kg bwt/day for 4 weeks) and anemia (25 mg/kg bwt/day for 60 days).

Reproductive effects

Inhalation exposure of female rats to 250 ppm (0.78 mg/L) carbon disulfide produced no reproductive toxicity; but exposure to 500 ppm (1.6 mg/L) produced litter loss, increased pup mortality and decreased pup viability and live litter size, in the presence of maternal toxicity (decreased body weight gain). Exposure of male rats to 600 ppm (1.9 mg/L) for 10 weeks affected mating behavior but there were no clear effects on sperm counts, circulating levels of reproductive hormones or testicular histology; and sperm counts and reproductive organ weights were not affected by exposure to 900 ppm (2.8 mg/L) for 12 weeks. There are reports of reduced libido and/or impotence in male workers exposed to high concentrations.

Developmental Toxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Developmental Toxicity

In developmental toxicity studies with rodents, inhalation of carbon disulfide produced decreased fetal weight and pup viability and increased pre- and post-implantation loss at >_400 ppm (1.2 mg/L) and teratogenic effects (unossified sternabrae in rats at 800 ppm [2.5 mg/L]; combined skeletal and visceral malformations in rabbits at 1200 ppm [3.7 mg/L]), generally in the presence of maternal toxicity (decreased bodyweight gain and, at 1200 ppm, CNS effects). Other studies of uncertain validity have reported teratogenic effects (club foot, hydrocephalus, microcephalus) and/or neurological effects, including behavioral alterations, in offspring of rats exposed to concentrations as low as 3.2 ppm (0.01 mg/L). There is no clear evidence of effects of carbon disulfide on human development.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Acute Fish toxicity

Summary: Predicted acute toxicity to fish is moderate (QSAR)

Acute toxicity to aquatic invertebrates

Summary: Predicted acute toxicity to aquatic invertebrates is moderate (QSAR).

Toxicity to aquatic plants

Summary: Predicted toxicity to aquatic algae is moderate (QSAR)

Toxicity to microorganisms

Summary: no data available

Chronic toxicity to fish

Summary: Predicted low chronic toxicity to fish (QSAR)

Chronic toxicity to aquatic invertebrates

Summary: Predicted low chronic toxicity to aquatic invertebrates (QSAR)

Environmental fate and pathways

See components summary.

Mobility

Behavior in environmental compartments: Significant volatilization from water or soil surfaces is expected.

COMPONENT INFORMATION

- *Propane* 74-98-6

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Acute toxicity to aquatic invertebrates

Summary: Predicted acute toxicity to aquatic invertebrates is moderate (QSAR).

Toxicity to aquatic plants

Summary: Predicted toxicity to aquatic algae is moderate (QSAR)

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

Summary: Predicted low chronic toxicity to fish (QSAR)

Chronic toxicity to aquatic invertebrates

Summary: Predicted low chronic toxicity to aquatic invertebrates (QSAR)

Environmental fate and pathways

Mobility

Behavior in environmental compartments: High Degree of volatilization from surface waters and soil is expected, with propane partitioning mainly to air.

Persistence and degradability

Biodegradation: Expected to be biodegradable. Not expected to be hydrolytically unstable. Photodegradation following atmospheric release is expected to be the most significant route of degradation in the environment.

Bioaccumulation: Bioconcentration factor (BCF) 13.1 (Calculation method) Bioaccumulation is unlikely.

- *Isobutane* 75-28-5

Ecotoxicity

No Data Available.

Environmental fate and pathways

This material is likely to evaporate from soil and water.

Persistence and degradability

Biodegradation: Expected to be biodegradable

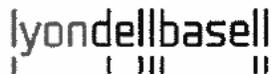
Bioaccumulation: This material is not expected to bioaccumulate.

- *n-Butane* 106-97-8

Ecotoxicity

This material is expected to be non-hazardous to aquatic species.

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

This material is likely to evaporate from soil and water.

Persistence and degradability

Stability in water: Not likely to adsorb to suspended solids and sediment in water.

Stability in soil: Expected to have very high to moderate mobility in soils. Volatilization from surface soil may be quite rapid, although this process may be slowed by dicyclopentadiene's adsorption to the soil. This compound is expected to display low mobility. Biodegradation and hydrolysis are not expected to be significant factors.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

- *1-Butene* 106-98-9

Ecotoxicity

No Data Available.

Environmental fate and pathways

Persistence and degradability

Stability in water: Not likely to adsorb to suspended solids and sediment in water.

Stability in soil: Expected to have very high to moderate mobility in soils. Volatilization from moist soil surfaces is expected.

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Not expected to bioaccumulate in aquatic organisms.

- *Isobutylene* 115-11-7

Ecotoxicity

No additional information available.

Acute Fish toxicity

/96.0 HOURS fish. 19 mg/l

Summary: (estimation)

Acute toxicity to aquatic invertebrates

/48 HOURS Daphnia 16 mg/l (estimation)

Summary: (estimation)

Toxicity to aquatic plants

/96 HOURS green algae. 6.9 mg/l

Summary: (estimation)

Toxicity to microorganisms

Summary: study scientifically unjustified

Chronic toxicity to fish

/30 d fish. 2 mg/l

Summary: (estimation)

Chronic toxicity to aquatic invertebrates

Daphnia 1.6 mg/l

Summary: (estimation)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Expected to exist solely as a vapor in the ambient atmosphere. Partitioning mainly to air.

Predicted distribution to environmental compartments: After release, disperses into the air.

Persistence and degradability

Stability in soil: Expected to have high mobility in soils. Volatilization from moist soil surfaces is expected.

Biodegradation: Inherently biodegradable. Photodegradation following atmospheric release is expected to be the most significant route of degradation in the environment.

Bioaccumulation: Bioaccumulation is unlikely.

- *1,3-Butadiene* 106-99-0

Ecotoxicity

Due to the physio-chemical characteristics of this material, no reliable test data are available.

Environmental fate and pathways

The atmosphere is the main environmental compartment for released butadiene where it will react rapidly with hydroxyl radicals (half-life 1 - 10 hr) and ozone (half-life 8 - 48 hr). In water, volatilization will result in substantial losses to the atmosphere with a half-life of about 4 hr.

Persistence and degradability

Biodegradation: Not readily biodegradable (but would be lost from open waters by evaporation).

Bioaccumulation: Bioconcentration factor (BCF) 10 - 13 (estimated) Bioaccumulation is unlikely.

- *Isopentane* 78-78-4

Ecotoxicity

This material is toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna*. 2.3 mg/l

Environmental fate and pathways

This material is likely to evaporate from soil and water.

Persistence and degradability

Stability in water: Volatilization from water surfaces is expected to be an important environmental fate process.

Stability in soil: Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

- *n-Pentane* 109-66-0

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss 4.3 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 9.7 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

Persistence and degradability

Stability in soil: Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Trans-butene-2* 624-64-6

Ecotoxicity

No Data Available.

Environmental fate and pathways

Expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

Persistence and degradability

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

- *2-Butene* 107-01-7

Ecotoxicity

No Data Available.

Environmental fate and pathways

Persistence and degradability

Stability in water: Volatilization from water surfaces is expected to be an important environmental fate process.

Stability in soil: Volatilization from moist soil surfaces is expected.

Bioaccumulation: Not expected to bioaccumulate in aquatic organisms.

- *Hydrogen sulfide* 7783-06-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Lepomis macrochirus 0.0448 mg/l (flow-through)

LC50 / 96 HOURS Pimephales promelas 0.016 mg/l (flow-through)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

Acute toxicity to aquatic invertebrates

EC50 / 96 HOURS *Gammarus pseudolimnaeus* 0.022 mg/l

Other adverse effects

No Data Available.

Environmental fate and pathways

When released into the environment, this material will volatilize rapidly. This material is not expected to persist in the environment.

Persistence and degradability

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Methyl Mercaptan* 74-93-1

Ecotoxicity

No data available.

Environmental fate and pathways

Other adverse effects

No Data Available.

- *Ethyl Mercaptan* 75-08-1

Ecotoxicity

No data available.

Environmental fate and pathways

Other adverse effects

No Data Available.

- *Dimethyl sulfide* 75-18-3

Ecotoxicity

No information on ecology is available.

Environmental fate and pathways

Other adverse effects

No Data Available.

- *Dimethyl Disulfide* 624-92-0

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

No data available.

Environmental fate and pathways

No data available.

- *Carbon Disulfide 75-15-0*

Ecotoxicity

No information on ecology is available.

Environmental fate and pathways

Other adverse effects

No Data Available.

13. DISPOSAL CONSIDERATIONS

Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations. Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. The materials resulting from clean-up operations may be hazardous wastes and therefore, subject to specific regulations.

14. TRANSPORT INFORMATION

Proper shipping name Petroleum gases, liquefied (Isobutane, n-Butane)
Reportable quantity 1,3 BUTADIENE
ID No. UN1075
Hazard class 2.1

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

All components of this product are listed or are exempt from listing on the TSCA 8(b) inventory. If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.

SARA 302/304

Component

TPQ

RQ



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

1,3-Butadiene		10 lbs
Hydrogen sulfide	500lbs	100 lbs
Methyl Mercaptan	500lbs	100 lbs
Carbon Disulfide	10000lbs	100 lbs

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
1,3-Butadiene	0.1%
Carbon Disulfide	1.0%

State Reporting

Known to the State of California to cause cancer.

106-99-0 1,3-Butadiene (December 11, 2009)

Known to the State of California to cause birth defects.

106-99-0 1,3-Butadiene (December 11, 2009)

75-15-0 Carbon Disulfide

Known to the State of California to cause reproductive toxicity in males.

106-99-0 1,3-Butadiene (December 11, 2009)

75-15-0 Carbon Disulfide

Known to the State of California to cause reproductive toxicity in females.

106-99-0 1,3-Butadiene (December 11, 2009)

75-15-0 Carbon Disulfide

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

74-98-6	Propane
75-28-5	Isobutane
106-97-8	n-Butane
106-98-9	1-Butene
115-11-7	Isobutylene
106-99-0	1,3-Butadiene
78-78-4	Isopentane
109-66-0	n-Pentane
624-64-6	Trans-butene-2
107-01-7	2-Butene
7783-06-4	Hydrogen sulfide
74-93-1	Methyl Mercaptan
75-08-1	Ethyl Mercaptan
75-18-3	Dimethyl sulfide
624-92-0	Dimethyl Disulfide
75-15-0	Carbon Disulfide

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

74-98-6 Propane



MATERIAL SAFETY DATA SHEET

MSDS No.: BE204
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

NORMAL BUTANE

75-28-5	Isobutane
106-97-8	n-Butane
106-98-9	1-Butene
115-11-7	Isobutylene
106-99-0	1,3-Butadiene
78-78-4	Isopentane
109-66-0	n-Pentane
624-64-6	Trans-butene-2
7783-06-4	Hydrogen sulfide
74-93-1	Methyl Mercaptan
75-08-1	Ethyl Mercaptan
75-18-3	Dimethyl sulfide
624-92-0	Dimethyl Disulfide
75-15-0	Carbon Disulfide

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

74-98-6	Propane
75-28-5	Isobutane
106-97-8	n-Butane
106-98-9	1-Butene
115-11-7	Isobutylene
106-99-0	1,3-Butadiene
78-78-4	Isopentane
109-66-0	n-Pentane
624-64-6	Trans-butene-2
107-01-7	2-Butene
7783-06-4	Hydrogen sulfide
74-93-1	Methyl Mercaptan
75-08-1	Ethyl Mercaptan
75-18-3	Dimethyl sulfide
624-92-0	Dimethyl Disulfide
75-15-0	Carbon Disulfide

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Last revision: Logo change. November 3 2010

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE204
Variant: U.S.A.-EN
Revision: 1.1
Validation Date: 11/05/2010

NORMAL BUTANE

Disclaimer

component in another product, this MSDS information may not be applicable.
Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE91
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

COKE

A0834
 HFR# 1.1.0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: COKE

Number: 00000000000016123

Chemical characterization: Carbon and Carbonaceous Materials

CAS-No.: 64741-79-3

Chemical Name: Coke (Petroleum)

Synonyms: Green petroleum coke, Delayed petroleum coke

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

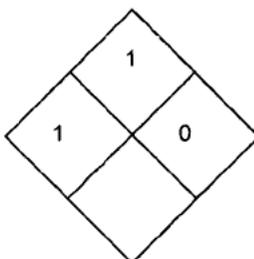
Signal Word

WARNING.

Hazards

Avoid contact with hot product - may cause burns. May be irritating to the eyes, skin, and respiratory system. Inhalation of excessive concentrations of dust may cause transient lung irritation.

NFPA®



HMIS®

Health	*	1
Flammability		1
Physical Hazard		0

Physical state

solid

Color

Black

Odor

Faint, mild hydrocarbon odor.

Odor Threshold



MATERIAL SAFETY DATA SHEET

MSDS No.: BE91
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

COKE

Odor Threshold

Specific data not available.

Potential health effects

Routes of exposure

Skin. Inhalation. Eye.

Acute effects

See componentsummary.

- *Coke (Petroleum) 64741-79-3*
 May be irritating to the eyes, skin, and respiratory system.

Skin

Avoid contact with hot product - may cause burns. Dust from this product may cause skin irritation.

Inhalation

Dust from this material may cause respiratory irritation if inhaled.

Eyes

Mechanical irritation is possible.

Ingestion

Ingestion not a likely route of exposure.

Chronic effects

See componentsummary.

- *Coke (Petroleum) 64741-79-3*
 Prolonged contact with the skin may cause mechanical irritation and subsequent dermatitis. Chronic inhalation may cause lung damage.

Aggravated Medical Condition

Personnel with preexisting skin disorders or chronic respiratory diseases should avoid exposure to this product.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Coke (Petroleum)	64741-79-3	265-080-3	< 100.0

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE91
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

COKE

Skin

Immediately flush the contact area with plenty of low pressure water to cool the skin. Immediately seek medical attention. Remove contaminated clothing and wash skin with plenty of soap and water. Seek medical attention if discomfort persists. Seek medical attention if ill effect or irritation develops. Wash clothing before wearing again.

Inhalation

Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

If hot dust or fines enter the eyes, immediately irrigate with large amounts of room-temperature water. Check for and remove contact lenses. Immediately flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower lids. If pain or irritation persists, promptly obtain medical attention.

Ingestion

Not expected to present a significant ingestion hazard under anticipated conditions of normal use. If product is ingested, do not induce vomiting and contact a physician or Poison Control Center.

Notes to physician

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

Combustible solid.

Flash point

No Data Available.

Autoignition temperature

No Data Available.

Lower explosion limit

Not applicable.

Upper explosion limit

Not applicable.

Extinguishing Media

Suitable extinguishing media

Water mist Foam Dry chemical

Unsuitable extinguishing media

Do not use solid water stream/may spread fire.

Protective equipment and precautions for firefighters

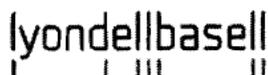
Protective equipment and precautions for firefighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.

Precautions for fire-fighting

Dust may form explosive mixtures with air. Avoid contact with hot material/prevent serious burns. Cool nearby material. Use waterspray/waterfog for cooling. This material may reignite.

Hazardous combustion products



MATERIAL SAFETY DATA SHEET

MSDS No.: BE91
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

COKE

Hazardous combustion products

Incomplete combustion may produce carbon monoxide, sulfur oxides, and other toxic gases.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Contain spill and evacuate all non-essential personnel. Use good housekeeping practices since spilled material may be a slipping hazard. In urban areas, cleanup spill as soon as possible; in natural environments, seek cleanup advice from environmental specialists. Equip cleanup crew with proper protection. On land, vacuum/shovel into suitable disposal containers. Use approved industrial vacuum cleaner for removal. Comply with all laws and regulations.

7. HANDLING AND STORAGE

Handling

Do not handle hot material. All electrical equipment should be grounded and conform to applicable electric codes and regulatory requirements. Electrostatic charges may be generated as a result of flow or agitation. Bond and ground all equipment before transferring this material from one container to another. Dust and fine formation is possible as this material dries. Do not breath dust or fumes and avoid conditions which create dust. Ensure use of appropriate personal protective clothing/equipment, including insulated gloves, if material is hot. Equipment containing this material should be isolated and thoroughly drained, washed and purged prior to maintenance/repair operations. Wash thoroughly after handling.

Storage

Keep container tightly closed and properly labeled. Ground all equipment containing this material. Use good housekeeping practices during storage, transferring and handling. Process enclosures and adequate ventilation should be used to avoid excessive dust accumulation.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use with adequate ventilation. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1) Local exhaust and general ventilation must be adequate to meet exposure limit(s). Special ventilation or high-efficiency vacuuming may be required to handle material at elevated temperatures or under mechanical agitation.

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Skin

Use chemical resistant gloves appropriate to conditions of use. If handling hot material, wear thermal resistant gloves. Where use can result in skin contact, practice good personal hygiene. Wash thoroughly after handling. Use insulated gloves, impervious apron, long sleeves and other protective clothing when handling this material hot, wash clothing frequently. Avoid contact with hot product - may cause burns. Avoid prolonged or repeated contact with skin. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Use a full-body heat-resistant or internally cooled suit when work conditions dictate.

Eyes

Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid, airborne particles, or vapor. Suitable eye wash water should be readily available.

Remarks



MATERIAL SAFETY DATA SHEET

MSDS No.: BE91
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

COKE

Remarks

Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. DO NOT use gasoline, kerosene, solvents, or harsh abrasive skin cleaners. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use.

Occupational Exposure Limits

Consult local authorities for acceptable exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: solid Black

Odor: Faint, mild hydrocarbon odor.

Odor Threshold: Specific data not available.

pH: Not applicable.

Boiling point/boiling range: Not applicable.

Melting/freezing point: Not applicable.

Flash point: No Data Available.

Autoignition temperature: No Data Available.

Flammability: Combustible solid.

Lower explosion limit: Not applicable.

Upper explosion limit: Not applicable.

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: Not applicable.

Evaporation rate: Specific data not available.

Relative density: ~ 1.0 - 1.5 (Water = 1)

Relative vapor density: > 10 (Air = 1.0 at 60-90°F)

Viscosity: Not applicable.

Water solubility: negligible

Partition coefficient: n-octanol/water: No Data Available.

Other physico-chemical properties: No additional information available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE91
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

COKE

10. STABILITY AND REACTIVITY

Chemical stability

Stable.

Conditions to avoid

Heat, sparks and open flame.

Materials to avoid

Strong acids, bases, and oxidizing agents, such as liquid chlorine and oxygen.

Hazardous decomposition products

Excessive heating and/or incomplete combustion may produce carbon monoxide and other harmful gases/vapors including oxides and/or other compounds of sulfur, nitrogen, and heavy metals.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

See components summary.

COMPONENT INFORMATION

- *Coke (Petroleum)* 64741-79-3

Acute effects

Inhalation

Specific data not available.

Ingestion

Specific data not available.

Skin contact

Specific data not available.

Irritation

Skin

May be irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Prolonged contact with the skin may cause mechanical irritation and subsequent dermatitis. Chronic inhalation may cause lung damage.

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE91
Variant: U.S.A.-EN
Revision: 1.1
Validation Date: 11/05/2010

COKE**12. ECOLOGICAL INFORMATION**

Product information

Ecotoxicity

See components summary.

Environmental fate and pathways

See components summary.

COMPONENT INFORMATION

- *Coke (Petroleum)* 64741-79-3

Ecotoxicity

This material is expected to have low toxicity to aquatic species. However, due caution should be exercised to prevent the accidental release of this material to the environment.

Environmental fate and pathways

Will either incorporate into sediment or float in the surface, depending on the particle size and density in relation to the water.

13. DISPOSAL CONSIDERATIONS

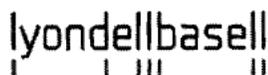
Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Contact the RCRA/ Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulation (see 40 CFR Parts 260 through 271).

14. TRANSPORT INFORMATION

Proper shipping name Petroleum Coke (Uncalcined), not regulated

15. REGULATORY INFORMATION

Notification status



MATERIAL SAFETY DATA SHEET

MSDS No.: BE91
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

COKE

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

This product contains no known chemicals regulated under SARA 302/304.

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Reactive.
 Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

This product contains no known chemicals regulated under SARA 313.

State Reporting

This product contains no known chemicals regulated by California's Proposition 65.

This product contains no known chemicals regulated by New Jersey's Worker and Community Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

This product contains no known chemicals regulated by Pennsylvania's Right to Know Act.

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Last revision: Logo change. November 3 2010

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE91
Variant: U.S.A.-EN
Revision: 1.1
Validation Date: 11/05/2010

COKE

Disclaimer**Numerical Data Presentation**

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

AP0845
 HER#2,1,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: SULFUR

Number: 00000000000016138

Chemical characterization: Non-metallic Element

CAS-No.: 7704-34-9

Synonyms: Molten Sulfur, Liquefied Sulfur, Hot Sulfur, Sulphur, S4, Sulfur Lava, Sublim e Suifur, Brimstone

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

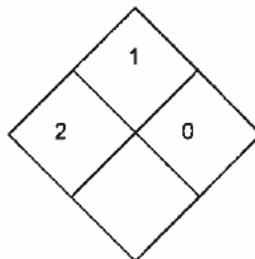
Signal Word

DANGER.

Hazards

Contact with hot liquid will cause thermal burns. May evolve potentially deadly sulfur dioxide or hydrogen sulfur gas. High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation. Severe eye irritant. Mucous membrane irritant.

NFPA®



HMIS®

Health	2
Flammability	1
Physical Hazard	0

Physical state

liquid

Color

Yellow.

Odor

Hydrogen sulfide; rotten eggs.

Odor Threshold

No value available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

Potential health effects

Routes of exposure

Skin. Eye.

Acute effects

See components summary.

- *Sulfur 7704-34-9*

May be irritating to the eyes, skin, and respiratory system.

- *Hydrogen sulfide 7783-06-4*

Hydrogen sulfide is a highly toxic gas that can be fatal in certain concentrations. Skin absorption hazard. Respiratory tract irritant. Inhalation may cause asthma-like symptoms, including coughing, wheezing, tightness of chest, shortness of breath, and headache. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), with severe shortness of breath. CNS depressant.

- *Sulfur dioxide 7446-09-5*

May be harmful or fatal if inhaled. Irritation of the eyes and respiratory system. Can cause severe irritation and burns of the eyes with possible permanent damage. Skin contact can cause severe skin irritation and burns. Contact with liquid may cause frostbite.

Skin

Avoid contact with hot product - may cause burns. Burns may be severe and cause permanent damage. This material may be absorbed through the skin.

Inhalation

Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression. Hydrogen sulfide is a highly toxic gas that can be fatal in certain concentrations.

Eyes

H₂S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).

Ingestion

Ingestion not a likely route of exposure. Harmful if swallowed. Burns may be severe and cause permanent damage.

Chronic effects

See component summary.

- *Sulfur 7704-34-9*

Repeated or prolonged contact with skin may cause allergic sensitization, allergic skin reaction or contact dermatitis.

- *Hydrogen sulfide 7783-06-4*

Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression. Repeated exposure may cause eye damage with possible loss of vision.

- *Sulfur dioxide 7446-09-5*

Lungs may be affected by repeated or prolonged exposure. May cause severe irritation or burns of respiratory system, pulmonary edema, lung inflammation, headache, coughing, difficult breathing, dizziness, chest pains, teeth damage and respiratory failure. Aspiration may cause pulmonary edema and pneumonitis.

Aggravated Medical Condition

Any pre-existing disorders or diseases of the: eyes neurological conditions Persons with pre-existing skin disorders, peripheral or central nervous system (CNS) disease, psychological conditions, cardiac conditions, impaired pulmonary, cardiovascular, or liver/kidney function, or chronic respiratory diseases should avoid exposure



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-BN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Sulfur	7704-34-9	231-722-6	99.98 <= 100.0
Hydrogen sulfide	7783-06-4	231-977-3	0.001 <= 0.015
Sulfur dioxide	7446-09-5	231-195-2	0.0 <= 0.01

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

If burned by hot material, cool skin by quenching with large amounts of cool water. Call a physician.

Inhalation

Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

Immediately flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower lids. If pain or irritation persists, promptly obtain medical attention.

Ingestion

Ingestion unlikely. However, if ingested, obtain emergency medical attention.

Notes to physician

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class III B combustible liquid.

Flash point

207 °C (404.6 °F) (Cleveland Closed Cup)

Autoignition temperature

232 °C (449.6 °F) (ASTM E659).

Lower explosion limit

0.35 - 4.3 vol%

Upper explosion limit

14.0 - 45.5 vol%



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: sand CO2 (carbon dioxide) water fog Inert gas - Halon/N2.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear. Structural firefighters' protective clothing is recommended for fire situations ONLY; it is not effective in spill situations.

Precautions for fire-fighting

Vapor is heavier than air, may travel long distance along the ground before igniting and flash back to vapor source. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Evacuate area and fight from a maximum distance or use unmanned hose holders or monitor nozzles. Heat may generate flammable or explosive vapors; disperse with water spray or cover pooling liquid with foam. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks.

Hazardous combustion products

Oxides of sulfur.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Do not touch or walk through spilled material. If liquid is hot, attempt to confine spill and let the liquid solidify. Equip cleanup crew with proper protection.

7. HANDLING AND STORAGE

Handling

Use good housekeeping practices during use, storage, transfer, and handling. All material sampling should avoid skin contact. Wash thoroughly after handling. Isolate, vent, drain, wash and purge systems or equipment before maintenance or repair. Eliminate every possible source of ignition. Use grounded electrical/mechanical equipment. Containers must be properly grounded before beginning transfer. Check atmosphere for explosiveness and oxygen deficiencies. Observe precautions pertaining to confined space entry.

Storage

Keep container tightly closed and properly labeled. Ground all equipment containing this material. Electrical installations should be in accordance with Articles 500 and 501 of the National Electrical Code (Class 1 Group D hazard locations). NFPA 30, Flammable and Combustible Code, should be followed for all storage and handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use adequate ventilation to keep vapor concentrations below applicable exposure limit(s). At elevated temperatures, special ventilation may be required even if the flash point has not been exceeded. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Skin

Wear heat protective gloves and clothing if there is a potential for contact with heated material. For repeated and prolonged contact use: Nitrile, Neoprene, or Butyl Rubber Gloves. Wear heat protective gloves and clothing if there is a potential for contact with heated material. Appropriate protective clothing should be worn to prevent skin contact. Depending on the conditions of use, protective gloves, apron, boots, head and face protection should be worn. Where use can result in skin contact, practice good personal hygiene.

Eyes

Wear chemical safety goggles plus full face shield to protect against splashing when appropriate (ANSI Z87.1).

Remarks

Use good personal hygiene practices. Wash thoroughly after handling with soap and water. Wash hands before eating, drinking, smoking, or using toilet facilities.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Hydrogen sulfide	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	20 ppm	None.
	NIOSH	IDLH	100 ppm	None.
Sulfur dioxide	US (ACGIH)	STEL	0.25 ppm	None.
	US (OSHA)	TWA	5 ppm 13 mg/m ³	None.
	NIOSH	IDLH	100 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Yellow.

Odor: Hydrogen sulfide; rotten eggs.

Odor Threshold: No value available.

pH: Not applicable.

Boiling point/boiling range: 444 °C (831.2 °F)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

Melting/freezing point: 113 - 115 °C (235.4 - 239 °F)

Flash point: 207 °C (404.6 °F) (Cleveland Closed Cup)

Autoignition temperature: 232 °C (449.6 °F) (ASTM E659).

Flammability: OSHA/NFPA Class IIIB combustible liquid.

Lower explosion limit: 0.35 - 4.3 vol%

Upper explosion limit: 14.0 - 45.5 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: ~ 0.1 mm Hg @ 140 °C (284 °F) 1.0 mm Hg @ 184 °C (363.2 °F)

Evaporation rate: negligible

Relative density: 1.96 - 2.06

Relative vapor density: > 10 @ 21.11 °C (70 °F)(Air = 1.0)

Viscosity: Not applicable.

Water solubility: Insoluble in cold water.

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

This product is normally stable. However, molten sulfur may react with oxygen in air and it can react exothermally with certain substances.

Conditions to avoid

Oxidizers. Reactive substances.

Materials to avoid

Avoid contact with copper and copper containing alloys. Nitrates. Strong oxidizing agents. Steel. Phosphorous compounds. Certain metals. Chlorates. Bromates. Carbides.

Hazardous decomposition products

Molten sulfur burns to form sulfur dioxide and can react with hydrocarbons and other organic substances to product toxic hydrogen sulfide and/or carbon disulfide.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

Product Summary

See component summary.

COMPONENT INFORMATION

- *Sulfur 7704-34-9*

Acute toxicity

LC50 (Inhl) rat > 9.23 MG/L 4 HOURS

LD50 (Oral) rat > 3,000 MG/KG

LD50 (Skin) rabbit > 2000 MG/KG

Repeated dose toxicity

No known chronic health effects.

- *Hydrogen sulfide 7783-06-4*

Acute toxicity

LC50 (Inhl) rat 0.701 MG/L 4 HOURS

Acute effects

Inhalation

Inhalation may cause CNS depression. Damages the respiratory system.

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Irritation

Eyes

Eye irritant.

Target Organs

Eye. Lung. Central nervous system effects. Nasal cavity. Respiratory system. Heart

Repeated dose toxicity

Repeated inhalation exposure of rats and mice to hydrogen sulfide for 90 days produced decreases in body weight gain and feed consumption at 80 ppm (0.11 mg/L), lesions in the nasal tract and (in rats) lung at >_ 30 ppm (0.04mg/L). Nasal lesions were also observed when rats were exposed to >_ 30 ppm for 10 weeks or >_ 80 ppm for 5 days. Decreased performance in neurological tests has been observed in rats exposed by inhalation to >_ 80 ppm hydrogen sulfide for 5 days; however, no neuropathologic findings were noted when rats and mice were exposed to 80 ppm for 90 days. Rabbits exposed half an hour per day for 5 days to 72 ppm (0.10 mg/L) experienced cardiac arrhythmia.

Reproductive effects

No significant alterations in reproductive performance were observed in rats exposed to 80 ppm (0.111 mg/L) hydrogen sulfide in an inhalation screening study. No treatment-related histopathological changes were found in reproductive organs of rats or mice exposed to up to 80 ppm for 90 days. No adverse effect on spermatogenesis was found when male rats were exposed to 220 ppm (0.306 mg/L) for 7 days, then mated with unexposed virgin females.

Developmental Toxicity

No signs of developmental toxicity, including effects on neurobehavioral performance, were seen in a well-conducted rat inhalation reproduction/developmental toxicity screening study at up to 80 ppm (0.111 mg/L); and no evidence of developmental toxicity was seen in three other studies in which rats were exposed to hydrogen sulfide during gestation at concentrations up to 220 ppm (0.306 mg/L). However, neuro-developmental toxicity studies with offspring of rats exposed to hydrogen sulfide during the gestation and lactation periods have found some alterations that are suggestive of neurotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

Developmental Toxicity

(e.g., alterations in cerebellar Purkinje cell growth and developmental neurochemical effects) after exposure to 20 ppm (0.028 mg/L). The toxicological significance of these findings in the absence of alterations in neurobehavioral performance is not known.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA

- *Sulfur dioxide* 7446-09-5

Acute toxicity

LC50 (Inhl) rat 2500 PPM 1 HOURS

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

See componentsummary.

Environmental fate and pathways

See componentsummary.

COMPONENT INFORMATION

- *Sulfur* 7704-34-9

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS 866 mg/l

Environmental fate and pathways

- *Hydrogen sulfide* 7783-06-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS *Lepomis macrochirus* 0.0448 mg/l (flow-through)

LC50 / 96 HOURS *Pimephales promelas* 0.016 mg/l (flow-through)

Acute toxicity to aquatic invertebrates

EC50 / 96 HOURS *Gammarus pseudolimnaeus* 0.022 mg/l

Other adverse effects



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

No Data Available.

Environmental fate and pathways

When released into the environment, this material will volatilize rapidly. This material is not expected to persist in the environment.

Persistence and degradability

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Sulfur dioxide* 7446-09-5

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

13. DISPOSAL CONSIDERATIONS

Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations. Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. The materials resulting from clean-up operations may be hazardous wastes and therefore, subject to specific regulations.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Sulfur, molten
Reportable quantity HYDROGEN SULFIDE
ID No. NA2448
Hazard class 9
Packing group III

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	NDSL
China	IECS
European Union	EINECS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE166
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 11/05/2010

SULFUR

Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Hydrogen sulfide	500lbs	100 lbs
Sulfur dioxide	500lbs	

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

This product contains no known chemicals regulated under SARA 313.

State Reporting

This product contains no known chemicals regulated by California's Proposition 65.

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

7704-34-9 Sulfur
 7783-06-4 Hydrogen sulfide
 7446-09-5 Sulfur dioxide

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

7704-34-9 Sulfur
 7783-06-4 Hydrogen sulfide
 7446-09-5 Sulfur dioxide

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

7704-34-9 Sulfur
 7783-06-4 Hydrogen sulfide
 7446-09-5 Sulfur dioxide

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Last revision: Logo change. November 3 2010

Disclaimer

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE166
Variant: U.S.A.-EN
Revision: 1.2
Validation Date: 11/05/2010

SULFUR

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

APO878

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

HFR# 241

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: CAT BB

Number: 00000000000016070

Chemical characterization: Butane/Butene Mix

CAS-No.: 68477-85-0

Synonyms: Refinery-grade low sulfur liquefied butanes/butenes mixture; BBs; B/B Stock; Butanes/Butylenes Mixture; Butane/Butene Mix; Technical-Grade Butene; Alkylation Unit Charge Stock; C4 Catalytic Cracked Gas; C4 Thermal Cracked Gas; C4- Rich Gas; Unrefined C4 Hydrocarbons; C4 Olefin/Alkane Hydrocarbon Mix.

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

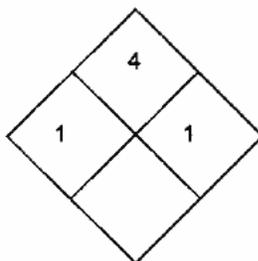
Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

Hazards

Extremely flammable gas. Vapor may cause flash fire or explosion. High Pressure and rapid diffusion hazard. May cause frostbite or freeze burns. CNS depressant. Simple asphyxiant. Possible cardiac sensitizer. Stream Components have been shown to cause reproductive and developmental toxicity in laboratory animals following repeated inhalation exposure. This stream contains genotoxic and carcinogenic components.

NFPA®



HMIS®

Health	*	2
Flammability		4
Physical Hazard		1

Physical state

gaseous

Color

Colorless.

Odor

Unpleasant.

Odor Threshold

No Data Available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

Potential health effects

Routes of exposure
 Inhalation. Skin. Eye.

Acute effects

Skin

Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

Inhalation

Inhalation of vapors may cause respiratory distress and CNS effects. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending on upon level of exposure concentration and/or duration.

Eyes

This gas is non-irritating; but direct contact with liquified/pressurized gas or frost particles may produce severe and possibly permanent eye damage from freeze burns.

Ingestion

Not a route of exposure for a gas.

Chronic effects

Repeated exposure, reproductive and developmental, genotoxic, and cancer hazard. See chapter 11. Toxicological information

Aggravated Medical Condition

Personnel with pre-existing chronic respiratory diseases should avoid exposure to this material

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Vol-%</u>
Gases (petroleum) C4-rich	68477-85-0		100.0
Propane	74-98-6	200-827-9	0.0 < 5.0
Propylene	115-07-1	204-062-1	0.0 < 4.5
Isobutane	75-28-5	200-857-2	24.0 < 38.0
n-Butane	106-97-8	203-448-7	4.0 < 21.0
1-Butene	106-98-9	203-449-2	9.0 < 16.5
Trans-butene-2	624-64-6	210-855-3	9.0 < 19.0
Isobutylene	115-11-7	204-066-3	12.0 < 18.5
2-Butene	107-01-7	203-452-9	6.0 < 12.5
Isopentane	78-78-4	201-142-8	1.0 < 4.0
n-Pentane	109-66-0	203-692-4	0.0 < 1.0
Cyclopentane	287-92-3	206-016-6	0.0 < 1.0
1,3-Butadiene	106-99-0	203-450-8	0.1 <= 0.35



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

The affected frozen tissue area should be placed in a warm water bath, with temperatures at or below 40C. DO NOT use: Dry Heat or Hot water. Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if discomfort persists.

Inhalation

Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

Check for and remove contact lenses. For contact with cold liquid or gas. Flush eyes with directed stream of lukewarm water for at least 15 minutes. GET MEDICAL ATTENTION IMMEDIATELY.

Ingestion

Ingestion unlikely.

Notes to physician

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

Extremely flammable gas.

Flash point

< -56 °C (< -68.8 °F) closed cup

Autoignition temperature

288 - 460 °C (550.4 - 860 °F)

Lower explosion limit

1.8 vol%

Upper explosion limit

15 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemicals, CO2 LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Structural firefighters protective clothing will only provide limited protection. Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

Precautions for fire-fighting

DO NOT extinguish a leaking gas fire unless leak can be stopped. Fires involving this material should not be extinguished unless the source flow can be stopped immediately. Shut off the source and allow the fire to burn itself out. If it can not be shut off immediately, all exposed equipment and surfaces must be cooled with water to prevent overheating, flash backs, or explosions. Control fire until source can be shut off. Potential explosion hazard from reignition, if fire is put out without shutting off source. Releases flammable vapors below normal ambient temperatures. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Extremely flammable gas. Release causes immediate fire/explosion hazard. Evacuate all non-essential personnel to an area upwind (at least 1/2 mile in all directions if tanks or tank cars are involved in fire or spill). Stop source of release with non-sparking tools before beginning clean-up or fire extinguishing. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Closed systems form white frost at the point of leak. Do not direct water at spill or source of leak. Eliminate all sources of ignition. Let evaporate. If possible, turn leaking container so that gas escapes rather than liquid. Do not direct water at spill or source. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas. Caution: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Liquid spills will vaporize forming cold dense vapor clouds that do not readily disperse. Avoid vapor cloud even with proper respiratory equipment. Contain spill with dike to prevent entry into sewers or waterways.

7. HANDLING AND STORAGE

Handling

Odor is not an adequate warning of potentially hazardous ambient air concentrations. Releases of these gases may cause atmospheres, some oxygen deficient, which can have flammable/explosive potential. Do not enter such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. During transfer of product, ground container and insure that all conveying equipment is properly grounded. Consult the U.S. National Fire Protection Association standard for the storage and handling of liquified petroleum gases (NFPA No. 58) for additional recommendations.

Storage

Keep containers tightly closed and in a well-ventilated place. Store away from oxidizers and other combustible material by a distance of at least 20 feet. Keep container tightly closed and properly labeled. Securely chain cylinders when in use and protect against physical damage. Store below 100°F (38°C). Protect from dampness, salt or corrosive materials. Store and transport in an upright container. Do not store together with oxidizing and self-igniting products.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal protective equipment

Inhalation

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

Skin

Use chemical resistant gloves appropriate to conditions of use. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use.

Eyes

Wear safety glasses as minimum eye protection. Conditions may warrant the use of chemical goggles and possibly a face shield. Consult your standard operating procedure or safety professional for advice. Use protective eye and face devices that comply with ANSI Z87.1-1987.

Remarks

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Propane	US (ACGIH)	TWA	1,000 ppm	None.
	US (OSHA)	TWA	1,000 ppm 1,800 mg/m ³	None.
	NIOSH	IDLH	2,100 ppm	None.
Propylene	US (ACGIH)	TWA	500 ppm	None.
Isobutane	US (ACGIH)	TWA	1,000 ppm	None.
n-Butane	US (ACGIH)	TWA	1,000 ppm	None.
Trans-butene-2	US (ACGIH)	TWA	250 ppm	None.
1-Butene	US (ACGIH)	TWA	250 ppm	None.
	US (ACGIH)	TWA	250 ppm	None.
Isobutylene	US (ACGIH)	TWA	250 ppm	None.
2-Butene	US (ACGIH)	TWA	250 ppm	None.
Isopentane	US (ACGIH)	TWA	600 ppm	None.
n-Pentane	US (ACGIH)	TWA	600 ppm	None.
	US (OSHA)	TWA	1,000 ppm 2,950 mg/m ³	None.
	NIOSH	IDLH	1,500 ppm	None.
Cyclopentane	US (ACGIH)	TWA	600 ppm	None.
1,3-Butadiene	US (ACGIH)	TWA	2 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
	NIOSH	IDLH	2,000 ppm	None.
Methyl Mercaptan	US (ACGIH)	TWA	0.5 ppm	None.
	US (OSHA)	CEILING	10 ppm 20 mg/m ³	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

	NIOSH	IDLH	150 ppm	None.
Ethyl Mercaptan	US (ACGIH)	TWA	0.5 ppm	None.
	US (OSHA)	CEILING	10 ppm 25 mg/m ³	None.
	NIOSH	IDLH	500 ppm	None.
Dimethyl Disulfide	US (ACGIH)	TWA	0.5 ppm	None.
Dimethyl sulfide	US (ACGIH)	TWA	10 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: gaseous Colorless.

Odor: Unpleasant.

Odor Threshold: No Data Available.

pH: Not applicable.

Boiling point/boiling range: -48 - 36 °C (-54.4 - 96.8 °F)

Melting/freezing point: -187 - -129 °C (-304.6 - -200.2 °F)

Flash point: < -56 °C (< -68.8 °F) closed cup

Autoignition temperature: 288 - 460 °C (550.4 - 860 °F)

Flammability: Extremely flammable gas.

Lower explosion limit: 1.8 vol%

Upper explosion limit: 15 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: 60 - 3900 kPa @ 20 °C (68 °F)

Evaporation rate: Appreciable.

Relative density: 0.506 - 0.583 @ 15 °C (59 °F) g/cm³

Viscosity: Not applicable.

Water solubility: 0.024 - 0.061 g/l @ 20 °C (68 °F)

Partition coefficient: n-octanol/water: <= 2.8 log Pow

Other physico-chemical properties: Low boiling point intensifies pressure and rapid diffusion hazard.

10. STABILITY AND REACTIVITY



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

Chemical stability

This product is stable when properly stored and is not expected to polymerize.

Conditions to avoid

Heat, sparks, open flames and strong oxidizing conditions.

Materials to avoid

Strong acids, bases, and oxidizing agents, such as liquid chlorine and oxygen. Halogens (bromine, chlorine, fluorine). Peroxides. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.

Hazardous decomposition products

Unburned hydrocarbons. Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Data for components are used as surrogate data for the health characterization of this product. Inhalation of very high concentrations of the Product may cause asphyxia, anesthesia, CNS stimulation followed by CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure), and possible cardiac sensitization. Exposure to methyl or ethyl mercaptans or dimethyl disulfide, if present, may also cause irritation of mucous membranes. dangerous levels of methyl or ethyl mercaptan may not be detected by odor. Very little of this Product is likely to be absorbed through the skin. Skin or eye irritation is not likely, but evaporating liquid might cause frost injuries. Skin sensitization is not expected. Available animal data for components of the stream demonstrate repeated exposure toxicity by the inhalation route of exposure, with species differences in affected target organ toxicity. Stream Components have been shown to cause reproductive and developmental toxicity in laboratory animals following repeated inhalation exposure. This stream contains genotoxic and carcinogenic components.

Acute toxicity

<u>LC50 (Inh).</u> (predicted; mixture of cis- and trans-2- butene)	rat	>23 MG/L (10,000 PPM)	4 HOURS
<u>LC50 (vapor).</u> Based on isopentane	mouse	413 MG/L (140,000 PPM)	2 HOURS

Acute effects

Inhalation

Stream expected to have a low order of acute inhalation toxicity based on toxicity information for components present at > 1%; however, stream occasionally contains methyl mercaptan or ethyl mercaptan at levels that may be dangerous to life and health (i.e., greater than 150 ppm, and 500 ppm respectively); and may contain dimethyl sulfide at levels causing 50% lethality in rats and mice (805 ppm and 500 ppm, respectively).

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

Stream is a gas with a low boiling point; hence, dermal uptake and resulting acute toxicity are unlikely.

Irritation

Skin

None expected. Evaporating liquid may cause frost bite.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

Eyes

None expected. Evaporating liquid may cause frost bite.

Sensitization

Not expected to be a sensitizer.

Target Organs

Central nervous system effects. Lymphohematopoietic system.

Repeated dose toxicity

May be toxic following repeated inhalation exposure to very high concentrations. Available animal data for components of the product demonstrate repeated exposure toxicity with species differences in affected target organs. The stream components demonstrating significant toxicity following repeated inhalation exposures are propane, propylene, isobutylene, 2-butene, 2-methyl-2-butene, methyl mercaptan, ethyl mercaptan and dimethyl sulfide; and their reported toxicological effects include: decreased body weight/weight gain; effects on the nasal tract, cardiovascular and hematopoietic systems, adrenal gland, thymus and kidney; changes in clinical chemistry parameters; nausea; irritation of mucous membranes; and a rise in olfactory threshold.

Reproductive effects

May cause reproductive toxicity. In a 13-week inhalation toxicity study conducted in rats, a stream having components in common with this stream produced no effects on reproductive organ weight or pathology; estrus cycle; or sperm count, motility or morphology. Available information from studies conducted in laboratory animals with most components of this stream (propane, propylene, n-butane, 1-butene, isobutylene, 2-butene, n-pentane, ethane, cyclopentane, 2-methyl-2-butene) shows no evidence of an effect on reproductive performance or reproductive organs at high inhalation doses. Dimethyl disulfide (present at <0.1%) produced no effects on reproductive organs in rats after initial toxicity at 250 ppm (0.96 mg/L) for 90 days. Two components (isobutane and 1,3-butadiene) have demonstrated possible reproductive toxicity. These effects included an increase in post-implantation loss, testicular and ovarian atrophy, and changes in sperm head morphology.

Developmental Toxicity

May be toxic to the developing embryo/fetus. No signs of developmental toxicity were seen in rats in an inhalation developmental toxicity study conducted with a stream having components in common with this stream. Available information from studies conducted in laboratory animals at high inhalation doses with most components of this stream (propane, propylene, n-butane, 1-butene, isobutylene, 2-butene, n-pentane, ethane, 2-methyl-2-butene) shows no evidence of developmental toxicity. Three components (isobutane, 1,3-butadiene and dimethyl disulfide) have demonstrated possible developmental toxicity. These effects included a reduction in fetal weight, an increase in post-implantation loss and retarded development.

Genetic Toxicity

May be genotoxic. A stream with components in common with this stream was negative in a micronucleus assay in rats exposed by inhalation. Most components of B-B Stock have produced negative results in a variety of in vitro and in vivo genotoxicity studies; however, two stream components (2-methyl-2-butene and 1,3-butadiene) have caused gene mutation and/or chromosome damage in rats and/or mice, after inhalation exposure, and another component (cyclopentane) was positive in an in vitro chromosome aberrations assay but negative in an in vivo micronucleus assay. Studies to assess genetic damage in humans exposed to 1,3-butadiene have returned inconsistent or equivocal results.

Carcinogenicity

This product contains carcinogenic components. Cancer data for components are used as surrogate data for this product. Animal data demonstrate marked species difference in carcinogenic response to butadiene. In the mouse, long term inhalation exposure is associated with an increased incidence of benign and malignant cancers in a wide range of tissues, whereas a more limited tumor profile is seen in the rat. Epidemiology studies suggest butadiene may be carcinogenic in humans with a concern for cancers of the lymphohematopoietic system.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

Acute Fish toxicity

Summary: Predicted acute toxicity to fish is moderate (QSAR)

Acute toxicity to aquatic invertebrates

Summary: Predicted acute toxicity to aquatic invertebrates is moderate (QSAR).

Toxicity to aquatic plants

Summary: Predicted toxicity to aquatic algae is moderate (QSAR)

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

Summary: Predicted low chronic toxicity to fish (QSAR)

Chronic toxicity to aquatic invertebrates

Summary: Predicted low chronic toxicity to aquatic invertebrates (QSAR)

Environmental fate and pathways

Persistence and degradability

Stability in Soil: Not expected to adsorb on soil.

Biodegradation: Readily biodegradable

Bioaccumulation: This material is not expected to bioaccumulate.

Other adverse effects

Photodegradation following atmospheric release is expected to be the most significant route of degradation in the environment.

13. DISPOSAL CONSIDERATIONS

Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations. Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. The materials resulting from clean-up operations may be hazardous wastes and therefore, subject to specific regulations.

14. TRANSPORT INFORMATION

Proper shipping name	Petroleum gases, liquefied (Isobutane, Isobutylene)
Reportable quantity	BUTADIENE
ID No.	UN1075
Hazard class	2.1



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	NDSL
European Union	EINECS
Korea	ECL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

All components of this product are listed or are exempt from listing on the TSCA 8(b) inventory. If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
1,3-Butadiene		10 lbs

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
Propylene	1.0%
1,3-Butadiene	0.1%

State Reporting

Known to the State of California to cause cancer.

106-99-0 1,3-Butadiene (December 11, 2009)

Known to the State of California to cause birth defects.

106-99-0 1,3-Butadiene (December 11, 2009)

Known to the State of California to cause reproductive toxicity in males.

106-99-0 1,3-Butadiene (December 11, 2009)

Known to the State of California to cause reproductive toxicity in females.

106-99-0 1,3-Butadiene (December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

74-98-6	Propane
115-07-1	Propylene
75-28-5	Isobutane
106-97-8	n-Butane
106-98-9	1-Butene
624-64-6	Trans-butene-2
115-11-7	Isobutylene
107-01-7	2-Butene
78-78-4	Isopentane



MATERIAL SAFETY DATA SHEET

MSDS No.: BE206
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 01/24/2011

CAT BB

109-66-0 n-Pentane
 287-92-3 Cyclopentane
 106-99-0 1,3-Butadiene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

74-98-6 Propane
 115-07-1 Propylene
 75-28-5 Isobutane
 106-97-8 n-Butane
 106-98-9 1-Butene
 624-64-6 Trans-butene-2
 115-11-7 Isobutylene
 78-78-4 Isopentane
 109-66-0 n-Pentane
 287-92-3 Cyclopentane
 106-99-0 1,3-Butadiene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

74-98-6 Propane
 115-07-1 Propylene
 75-28-5 Isobutane
 106-97-8 n-Butane
 106-98-9 1-Butene
 624-64-6 Trans-butene-2
 115-11-7 Isobutylene
 107-01-7 2-Butene
 78-78-4 Isopentane
 109-66-0 n-Pentane
 287-92-3 Cyclopentane
 106-99-0 1,3-Butadiene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. December 2010

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Information is correct to the best of our knowledge at the date of the MSDS publication.

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE206
Variant: U.S.A.-EN
Revision: 1.0
Validation Date: 01/24/2011

CAT BBNumerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet

HoustonRefining

A Lyondell Company

AP0881
HFR # 320

Heavy Cycle Oil (HCO)

Material Safety Data Sheet

Company

Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

MSDS No. AP0881

Revision Date 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Viscous liquid
Color Dark yellow to brown. **Odor** Slight burnt or cracked hydrocarbon

WARNING! Combustible liquid; vapor may cause flash fire.
Vapors and fumes may be hazardous or fatal!
Long-term heated storage (100° to 150°F) might evolve hydrogen sulfide, a flammable, toxic, sensitizing, and potentially deadly gas!
When heated, may cause thermal burns on contact! If hot product contacts water, a violent eruption of steam and vapor may occur!
Mist or vapor may severely irritate the eyes and respiratory tract!
Liquid contact may cause minimal eye and/or mild to moderate skin irritation and inflammation!
Contains 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbozoles!
May cause skin cancer following extended and/or repeated contact!
May be harmful to target organs and/or adversely affect reproduction if absorbed through the skin! Wash thoroughly after handling.
Spills may create a slipping hazard!

Hazard Rankings

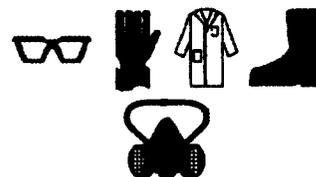
	HMIS	NFPA
Health Hazard	* 3	1
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

**Minimum Requirements
See Section 8 for Details**

This recommendation reflects minimum PPE when product is at elevated temperatures



SECTION 1: IDENTIFICATION

Trade Name Heavy Cycle Oil (HCO)**Product Number** 1044310443**CAS Number** 64741-61-3**Product Family** Petroleum Hydrocarbon Gas Oil

Synonyms Heavy Cycle Oil from a Fluid Catalytic Cracker Unit; FCCU Heavy Cycle Oil; 732 Unit HCO; Heavy Catalytic Cracked Distillate (Petroleum), Catalytic Cracked Heavy Gas Oil; FCCU Heavy Distillate; Heat Medium Oil; Coker Unit Feed Component; Heavy Fuel Oil Blending Component; Unfinished No. 5 Fuel, No 5 Fuel Oil Blending Component; C15-C35 Petroleum Hydrocarbons.

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Heavy Catalytic Cracked Distillate (Petroleum)	64741-54-4	100
2) C15-C36 Saturated Hydrocarbons and Naphthenes	Mixture	75-95
3) Polynuclear Aromatic Hydrocarbons (4- to 6-member condensed-ring type)	68487-58-6	5-25
4) Chrysene (Benzo[a]phenanthrene)	218-01-9	0.08-0.15
5) 5-Methylchrysene	3697-24-3	0.08-0.15
6) Hydrogen sulfide	7783-06-4	0.0001-0.01

Heavy Cycle Oil (HCO)

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled! Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H ₂ S) are immediately dangerous to life and health. Concentrations of H ₂ S at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. H ₂ S concentrations between 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, and/or low blood pressure. At greater than 500 ppm, H ₂ S causes sudden collapse, unconsciousness, and respiratory paralysis leading to convulsions, coma, and/or death. (See Section 11.)
Eye Contact	Upon direct contact, hot material may cause severe thermal burns. Animal test results on similar unheated materials suggest that this product may cause minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness. H ₂ S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).
Skin Contact	Skin contact with hot material may result in severe thermal burns. Animal test results on similar materials suggest that this material can cause moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage. Based upon a similar product's animal test results, a mild allergic skin response may be expected on some sensitive individuals following repeated exposures.
Ingestion	Contact with hot material may cause thermal burns. If swallowed, no significant adverse health effects are anticipated, however, this material can cause a laxative effect. Ingestion of large quantities can cause intestinal obstruction.
Chronic Health Effects Summary	Heavy aromatic oils similar to this material have been shown to be mutagenic, induce skin tumors, and cause adverse effects in the liver, kidneys, thymus, adrenal glands, bone marrow, testes, and embryo/fetus of laboratory animals following prolonged and repeated application. It is considered to be potentially teratogenic. This heavy catalytic cracked distillate is also a heavy residual oil distillate similar to those shown to produce skin tumors and adverse effects in the liver and kidneys of laboratory animals following prolonged and repeated applications. All tumors appeared at the site of application. Toxic effects are unlikely to occur if good personal hygiene is practiced. Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing nervous system disease, cardiac or neurological conditions, skin disorders, chronic respiratory diseases, impaired lung, liver, kidney, thymus, or bone marrow function, anemia, red blood cell abnormalities, or immune system deficiencies should avoid exposure.
Target Organs	This substance is toxic to respiratory tract and lungs, central nervous system, heart, mucous membranes, skin, eyes, and possibly, the liver, kidneys, thymus, adrenal glands, blood, bone marrow, immune system, testes, and unborn embryo/fetus.
Carcinogenic Potential	This material contains numerous 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAH) at concentrations at or above 0.1%. Some of these compounds has been determined to be carcinogenic by OSHA, IARC, and NTP.

Heavy Cycle Oil (HCO)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)									
OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If hot material is splashed into eyes, irrigate with large amounts of room-temperature water. Seek medical attention immediately. If ambient temperature material is splashed into eyes, check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	If burned by hot material, cool skin by quenching with large amounts of cool water. Do not remove material from the skin. Seek medical attention immediately. For contact at ambient temperatures, remove contaminated shoes and clothing. Wipe off excess material. Wash exposed skin with soap and water. If tissue appears damaged or if irritation or pain persist, apply a clean dressing and seek medical attention. Do not use ointments. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting or give anything by mouth. Rinse out mouth with water. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Do not leave victim unattended. Allow small quantities to pass through system. If large amounts are swallowed or irritation or discomfort occurs, seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. If only cough or difficulty in breathing develop, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis using pulmonary function tests and chest x-rays. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may affect the hematopoietic system or cause hepatotoxicity and/or nephrotoxicity. A complete blood count, liver function tests, renal function tests and urinalysis are suggested for significant exposures. In addition, monitoring arterial blood gases is suggested for significant exposures.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IIIA Liquid. Moderately combustible!		
Flash Point Method	CLOSED CUP: 75° to 80°C (167° to 178°F) (Setiflash Open Cup [ASTM D-92]).		
Lower Flammable Limit	1.0 to 4.0%	Upper Flammable Limit	7 to 44%
Autoignition Temperature	260° to 343°C (500° to 650°F)		

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Heavy Cycle Oil (HCO)

Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.
Special Properties	This "Combustible Liquid" releases vapors at or approaching its flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire. If stored under heat for extended periods or significantly agitated, this material might evolve or release hydrogen sulfide, a flammable gas, which can raise and widen this material's actual flammability limits and significantly lower its autoignition temperature. (See Section 7.)
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid. Evacuate non-essential personnel and remove all ignition sources. Carefully contain spill and stop source of spill if it can be done without risk. Do not touch or walk through spilled material. Cleanup crews must wear proper heat-resistant protective clothing. Remove spillage immediately from hard, smooth walking areas. Allow material to cool. Water mist or spray may be used to reduce heat or disperse vapors; but, it may not prevent ignition in closed spaces. This material will normally float on water. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid/semi-solid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling	A spill or leak may cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally. When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.
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Heavy Cycle Oil (HCO)

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and properly labeled. Keep away from all ignition sources! Do not store with strong oxidizing agents. Hydrogen sulfide vapors may be evolved from long-term heated storage and/or agitated transport. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION**Engineering Controls**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

This recommendation reflects minimum PPE when product is at elevated temperatures.

**Eye Protection**

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

When handling hot materials or those that might produce thermal burns, use long-cuffed leather or heat-resistant gloves over chemically-resistant gloves. When product is at ambient temperatures, use disposable gloves (PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

WARNING! Do not use this material as a fuel without adequate ventilation. Inadequate ventilation can result in hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is not adequate to warn of hazardous conditions.

The standards for "coal tar pitch volatiles, as benzene solubles" are based upon coal coking, not upon petroleum-derived oils. However, in 29 CFR 1910.1200.1002, OSHA has defined "coal tar pitch volatiles" to include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood and other organic matter. Accordingly, the coal tar pitch volatile standard may apply to the aerosol form of this material. The "hydrogen sulfide" standards apply only to vapors evolved from long-term heated storage and/or transport.

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Heavy Cycle Oil (HCO)

Occupational Exposure Guidelines

Substance

1) Hydrogen sulfide

2) Oil mist, mineral

3) Coal tar pitch volatiles, as benzene solubles
("A1" Confirmed Human Carcinogen)4) Oil mist, mineral, sum total of 15 PAHs
listed as carcinogens by US NTP

5) Chrysene (Benzo[a]phenanthrene)

Applicable Workplace Exposure Levels

TWA: 10 STEL: 15 (ppm) from ACGIH (TLV)
 TWA: 5 (ppm) from ACGIH (TLV) [Proposed]
 TWA: 10 STEL: 15 CEIL: 20 (ppm) from (PEL) OSHA [Proposed]
 TWA: 5 STEL: 10 (mg/M³) from ACGIH (TLV)
 TWA: 5 (mg/M³) from OSHA (PEL)
 TWA: 0.2 (mg/M³) from ACGIH (TLV)
 TWA: 0.2 (mg/M³) from OSHA (PEL) [Proposed]
 TWA: 0.005 (mg/M³) from ACGIH (TLV) [Proposed]

"A3" Animal Carcinogen from ACGIH

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Viscous liquid	Color	Dark yellow to brown	Odor	Slight burnt or cracked hydrocarbon.
Specific Gravity	0.985 to 0.995 at 60°F (Water = 1)	pH	Not applicable	Vapor Density	> 10 (Ar = 1 at 70°F)
Boiling Point/Range	260° to 500°C (500° to 932°F) (ASTM D-86)			Melting/Freezing Point	< 24°C (< 75°F) (ASTM D-97)
Vapor Pressure	< 0.1 mm of Hg at 21°C (70°F).			Viscosity (cSt @ 40°C)	42.7 to 53.5 (ASTM D-445)
Solubility in Water	Negligible in cold water (LT 0.001%).			Volatile Characteristics	Negligible; no Volatile Organic Compounds (VOCs) present at 450°F.

Additional Properties: Average Calculated Density at 60°F = 8.247 lbs./gal. (ASTM D-2161);
 Saybolt Viscosity = 200 to 250 SUS at 100°F (38.7°C) (ASTM D-2161);
 90% Boiling Point Temperature = 850° to 905°F (455° to 485°C) (ASTM D-86);
 Sulfur Content = 0.5 to 1.5 Wt.% (ASTM D-2622);
 Evaporation Rate = < 0.005 when n-Butyl acetate = 1.0.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine and oxygen. Hydrogen sulfide is dangerously reactive with strong oxidizers (nitric acid, chlorine, fluorine, etc.), some metals, metal oxides, and metal powders. H ₂ S is corrosive to some metals and alloys, especially those containing copper and/or tungsten.		
Hazardous Decomposition Products	Composition suggests that sulfur and nitrogen compounds might be generated; but, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Heavy Catalytic Cracked Distillate (Petroleum):

GAS (LC₅₀): Acute: >3.6 mg/L (Rat screen level).
ORAL (LD₅₀): Acute: 21.2 ml/kg (Rat).
DERMAL (LD₅₀): Acute: >2,000 mg/kg (Rabbit screen level).
DRAIZE EYE: Acute: Non-irritating to minimal eye irritant (Rabbit)
DRAIZE DERMAL: Acute: Moderate skin irritant (Rabbit).
BUEHLER DERMAL: Acute: Non-sensitizing (Guinea Pig).
IP DERMAL: Acute: Tumor initiator & possibly promoter activity (Mouse).
27-Week DERMAL: Chronic: 20 mg/kg 3x/week (Mouse) - Significant increase in contact-point skin tumors (on 81% of the animals) with 13-week mean latency and decreased survivability (30% mortality).

Heavy Cycle Oil (HCO)

A TSCA Section 8(e) notification from the American Petroleum Institute states that a long-term mouse skin painting study using **heavy catalytic cracked distillate** showed it to be severely irritating and tumorigenic. It also produced 59% mortality before sacrifice which occurred on day 193 due to poor health of the surviving animals.

The International Agency for Research on Cancer (IARC) has specifically evaluated **aromatic oils, including high-boiling fractions of catalytically cracked oils**, and determined them to be carcinogenic to experimental animals, and potentially humans. Also, the National Toxicology Program (NTP), U.S. Environmental Protection Agency (EPA), and American Conference of Governmental Industrial Hygienists (ACGIH) have independently classified various polynuclear aromatic hydrocarbon (PNA) compounds present in this product as "confirmed human (A1), suspected human (A2), or animal carcinogens (A3)".

This material contains **polycyclic aromatic hydrocarbons (PHAs or PNAs)**, some of which have been reported to cause skin cancer on humans under conditions of poor personal hygiene, prolonged/repeated contact, and exposure to sunlight. This material may also contain **alkylcarbazoles and alkylbenzocarbazoles** which if absorbed through the skin might be responsible, in whole or in part, for systemic toxicity to the liver, kidneys, spleen, and/or testes based upon limited laboratory animal studies.

Catalytic Cracked Clarified Oil [a similar material]:

28-Day DERMAL Sub-chronic 0% Mortality at 200, 10% at 400, 40% at 1,000, & 100% at 2,000 & 4,000 mg/kg/day (Rat & Rabbit) - Edema, skin ulceration, and depression. Minimal to moderate diffuse hepatocytomegaly in all animals at 400 mg/kg/day, slight skin hyperplasia and hyperkeratosis. Liver, thymus, and testes damage and increased liver-to-body weight ratios at 400 & 1,000 mg/kg/day. Studies at 2,000 and 4,000 mg/kg/day were terminated on day 11 due to early deaths.

12-Week DERMAL Sub-chronic: 5% Mortality at 40, 35% at 200, & 100% at 400 mg/kg/day (Rat) - Hepatocellular necrosis and generalized systemic toxicity.

52-Week DERMAL: Chronic: 5 uL/kg 2x/week (Mouse) - Significant increase in contact-point skin tumors with 22-week mean latency, increased liver and liver-to-body weight ratios, & decreased survivability (87% mortality).

104-Week DERMAL Chronic: 0.5 uL/kg 2x/week (Mouse) - 90% of the animals had contact-point skin tumors with 72-week mean latency.

MUTAGENICITY: Many different in-vivo and in-vitro mutagenic assays have shown "positive" responses with or without S9 metabolic activation. The only "negative" mutagenic responses were when using the Mouse Cell Transformation Assay without S9 activation, in-vitro Chinese Hamster Ovary Cell Assay, and in-vivo Mouse Bone Marrow Assay.

TERATOGENESIS:

in-vitro Ovarian Tumor Attachment Inhibition Assay Suspect teratogen (rating 3) (Mouse)

Embryonic Palatal HEPM Cell Growth Inhibition Assay Suspect teratogen (rating 3) with and without S9 metabolic activation (Human)

A TSCA Section 8(e) notification from Mobil Oil Company states that **catalytically cracked clarified oil** was not only carcinogenic, but also produced severe dose-dependent, organ-specific (liver, kidney, and testes) damage in rats during a 90-day sub-chronic dermal assay. Mortality occurred in 5% of the animals at 30 mg/kg/day, 55% at 125, 85% at 500, and 100% at 2,000. As a result of conducting additional dermal absorption studies, Mobil Oil believes that it is likely that alkyl- and alkylbenzocarbazoles present in this oil may have been responsible, in whole or in part, for the systemic toxicity. Epidemiology studies of Mobil refinery workers have not shown any effects corresponding to those observed in animals.

Hydrogen sulfide (H₂S):

GAS	(TE ₀₁)	Acute	AP 1 ppm (Human) - Odor response threshold
GAS	(TC ₀₁)	Acute	AP 10 ppm (Human) (15 minutes) - Eye irritation
GAS	(TC ₁₀)	Acute	50 to 100 ppm (Human) (15 minutes) - Respiratory irritation.
GAS	(LC ₁₀)	Acute	600 ppm (Human) (30 minutes) - Unconsciousness, respiratory paralysis, and death.
GAS	(LC ₁₀₀)	Acute	600 to 750 ppm (Human) (15 minutes) - Unconsciousness, respiratory paralysis, and death.
GAS	(LC ₁₀)	Acute	5,700 ug/kg (Human) - Chronic pulmonary edema, coma, and death.
GAS	(LC ₁₀)	Acute	800 ppm (Rat) (5 minutes)
GAS	(LC ₅₀)	Acute	635 ppm (Mouse) (1 hour)
GAS	(LC ₅₀)	Acute	445 ppm (Rat) (4 hours) - Hypermotility, diarrhea, and increased urine volume.
5-Day GAS	Sub-chronic	1,200 mg/M3 (Rat) (2 hours/day)	Decreased cholinesterase and degenerative brain changes.

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Heavy Cycle Oil (HCO)

35-Day GAS: Sub-chronic 100 ppm (Rat) (8 hours/day) - Decreased cytochrome oxidases and degenerative brain and pulmonary effects.

90-Day GAS: Sub-chronic: 80 ppm (Rat & Mouse) (6 hours/day) - Decreased brain weight and weight loss or decreased weight gain

TERATOGENESIS: Sub-chronic: 20 ppm for 24 hours on days 6 thru 22 of pregnancy (Rat) - Developmental physical effects.

OTHER REPRODUCTIVE EFFECTS: One unconfirmed study mentions H₂S as causing damage to the human testes and/or male reproduction. Recent studies do not confirm this association. Other studies mention increased risk of miscarriage, abortion, and difficulties during pregnancy and labor, but these studies involved mixed chemical exposures and/or physical confounders.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (<20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (>50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their offspring slowed developmental physical effects.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this heavy distillate, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This material is estimated to have a slow rate of biodegradation. Based upon spill investigation analysis, oils containing polynuclear aromatic hydrocarbon compounds similar to this material were shown to bioaccumulate in tissues of various aquatic organisms.

Environmental Fate

This heavy residual oil is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components gradually evaporating. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase slowly. This material is slowly biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment with plenty of agitation. In sewage-seeded wastewater, at or below concentrations of 0.2 vol. % of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

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Heavy Cycle Oil (HCO)

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT) only when transported in bulk.		
Proper Shipping Name	Not regulated in non-bulk containers (Petroleum oil, N.O.I.B N), Combustible liquid for bulk container shipments.		
	This product has a flash point temperature of between 140° and 200°F (60° to 93°C), so for bulk shipments, it is classified as a DOT "Combustible liquid". However, according to 49 CFR 173.150(f)(2), certain transportation-related requirements, such as labeling, may not apply to this product when shipped in non-bulk "limited quantity" containers of less than 119 gallons capacity. However, pursuant to 49 CFR 173.150(b) and 173.150(f)(3), "limited-quantities" offered for or transported via aircraft or products which are defined as DOT "Marine Pollutants" may be subject to DOT regulation.		
Hazard Class	Not a DOT regulated material or "Combustible liquid"	Packing Group(s) UN/NA ID	Not applicable or PG III. Not applicable or NA1993
Reportable Quantity	The Reportable Quantity (RQ) substance components in this material which might require DOT HAZMAT bill-of-lading display are Chrysene (Benzo[a]phenanthrene) and Hydrogen sulfide.		
Placards	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>A Combustible placard may not be required for this material when transported in a non-bulk container with a maximum capacity LT 450 L (LT 119 Gal)</p> </div>	Emergency Response Guide No.	Not applicable or 128
		HAZMAT STCC No.	49 122 12
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8
			

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A minor component substance of this material subject to the reporting requirements under this statute is Hydrogen sulfide [CAS No. 7783-06-4].
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) and Chronic (Delayed) Health Hazards, and the Fire Hazard.
SARA 313	This material contains the following components in concentrations which might be present at or above de minimis levels and they are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] concentration: 0.08 to 0.15% 6-Methylchrysene [CAS No. 3697-24-3] concentration: 0.08 to 0.16%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] (RQ = 100 lbs. [45.36 kg]) conc.: 0.08 to 0.15% Benzo[a]anthracene [CAS No. 86-86-3] (RQ = 10 lbs. [4.536 kg]) concentration: 0.04 to 0.05% Benzo[a]pyrene [CAS No. 50-32-8] (RQ = 1 lb. [0.4536 kg]) concentration: 0.007 to 0.011% Benzo[b]fluoranthene [CAS No. 205-99-2] (RQ = 1 lb. [0.4536 kg]) concentration: 0.005 to 0.015% Benzo[k]fluoranthene [CAS No. 207-08-9] (RQ = 5000 lbs. [2270 kg]) concentration: 0.002 to 0.004% Indeno[1,2,3-c,d]pyrene [CAS No. 193-39-5] (RQ = 100 lbs. [45.36 kg]) concentration: 0.001 to 0.003% Hydrogen sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.0001 to 0.01%.

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Heavy Cycle Oil (HCO)

CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains detectable concentrations of the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it might be subject to requirements of California Health & Safety Code Section 25249.5: 8-Methylchrysene [CAS No. 3897-24-3] concentration: 0.08 to 0.15% Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] concentration: 0.08 to 0.15% Benzo[a]anthracene [CAS No. 56-55-3] concentration: 0.04 to 0.06% Benzo[a]pyrene [CAS No. 50-32-8] concentration: 0.007 to 0.011% Indeno[1,2,3-c,d]pyrene [CAS No. 193-39-5] concentration: 0.001 to 0.003% Benzo[b]fluoranthene [CAS No. 206-99-2] concentration: 0.005 to 0.015% Benzo[k]fluoranthene [CAS No. 206-82-3] concentration: 0.003 to 0.005% Benzo[k]fluoranthene [CAS No. 207-08-8] concentration: 0.002 to 0.004%.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. A chemical substance present in this material which is subject to this statute is Hydrogen Sulfide.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION	Logo and Manufacturer name change.
Version Number	4.1
Revision Date	11/01/06

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****

Light Gas Oil

Material Safety Data Sheet

Company

Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

MSDS No. AP0883
Revision Date 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent to opaque, slightly pale to yellow. **Odor** Characteristic, heating oil-like

WARNING! Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!
Liquid contact may cause minimal eye irritation and/or mild to severe skin irritation and inflammation!
Contains 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs)! Based upon laboratory animal studies, may cause skin cancer following extended contact!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects!
May be harmful or fatal if ingested! Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia!
Spills may create a slipping hazard!
If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects!
Long-term exposure to fuel exhaust particulates may cause cancer!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name Light Gas Oil
Product Number 3609536095
CAS Number 64741-58-8
Product Family Petroleum Hydrocarbon Intermediate Distillate
Synonyms Light Vacuum Gas Oil (Petroleum), LVGO, Vacuum Tower Light Gas Oil, Intermediate Vacuum Distillate; Vacuum Tower Intermediate Distillate; Light Paraffinic Vacuum Distillate, Olefins Plant Feed-Heavy, OPF-Heavy, 634 HDS Unit Feed, 536 and 537 Crude Unit Light Vacuum Gas Oils, LGO Stream from a Vacuum Still, Untreated, Unrefined, or Raw No. 4 Fuel Oil, Unfinished Heavy Heating Oil, Furnace Oil, or Burner Fuel, C12-C30 Petroleum Hydrocarbons

Business Contact

Product Safety 800-700-0946
24 Hour Emergency Contact
CHEMTREC 800-424-9300
CANUTEC-Canada 613-996-6666
LYONDELL 800-245-4532

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Light Vacuum Gas Oil (Petroleum)	64741-58-8	100
2) Biphenyl (Diphenyl)	92-52-4	0-1.5
3) C13-C30 Saturated Hydrocarbons and Naphthenes	Mixture	59-80
4) C13-C30 Aromatic Hydrocarbons	Mixture	20-40
5) Polynuclear Aromatic Hydrocarbons (4- to 6-member condensed-ring type)	68487-58-6	0-1.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

- Inhalation** Breathing mist or vapors may irritate the mucous membranes of the nose, throat, bronchi, and lungs, and may cause transient central nervous system (CNS) depression. CNS symptoms include headache, dizziness, nausea, intoxication, blurred vision, slurred speech, flushed face, confusion, weakness, fatigue, loss of consciousness, convulsions, coma, and death, depending on the concentration and/or duration of exposure.
- Eye Contact** Animal test results on this material and similar materials suggest that it causes none to minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness.
- Skin Contact** Animal test results on similar materials suggest that this product can cause mild to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
- Ingestion** If swallowed, this material may irritate the mucous membranes of the mouth, throat, esophagus, and stomach. It can be readily absorbed by the stomach and intestinal tract. Ingestion can produce a burning sensation of the mouth and esophagus and central nervous system depression. Symptoms of CNS depression may include nausea, vomiting, dizziness, staggering gait, drowsiness, shallow rapid pulse, diarrhea, restlessness, sedation, inadequate respiratory function, and heart irregularities. Higher doses may cause loss of consciousness and delirium prior to the onset of convulsions, coma, and death (see "Inhalation" above). A lethal dose may be as low as one-half ounce for a child and one ounce for an adult human.

Due to its low viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration of a small amount of liquid can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

This **light vacuum gas oil** is a **middle distillate** similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced.

Biphenyl (Diphenyl) may cause liver and/or nerve damage. (See Section 11.)

Conditions Aggravated by Exposure Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases should avoid exposure.

Target Organs This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the liver and kidneys.

Carcinogenic Potential This material is an **intermediate distillate** and contains certain **polynuclear aromatic hydrocarbons** at above 0.1%. It is considered carcinogenic by IARC and OSHA. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Light Gas Oil

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IIIB Combustible Material Slightly combustible!
Flash Point Method	CLOSED CUP 112° to 121°C (235° to 250°F) (Pensky-Martens Closed Cup [ASTM D-93])
Lower Flammable Limit	AP 0.6 % Upper Flammable Limit AP 5.8 %
Autoignition Temperature	AP 262°C (505°F)
Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur.
Special Properties	This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire. A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.

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Light Gas Oil

Fire Fighting Protective Clothing

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material should be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak may cause a potential fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N F P A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

- Engineering Controls** Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below) All electrical equipment should comply with the NFPA NEC Standards Ensure that an emergency eye wash station and safety shower are near the work-station location
- Personal Protective Equipment** Personal protective equipment should be selected based upon the conditions under which this material is used A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations The following pictograms represent the minimum requirements for personal protective equipment For certain operations, additional PPE may be required



- Eye Protection** Safety glasses with side shields are recommended as a minimum protection During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn Suitable eye wash water should be readily available
- Hand Protection** Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners
- Body Protection** Avoid skin contact It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn This might include long-sleeves, apron, slicker suit, boots, and additional facial protection If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower Contaminated leather goods should be removed promptly and discarded
- Respiratory Protection** For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided Protection factors vary depending upon the type of respirator used Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2)
- General Comments** WARNING! Do not use this material as a fuel without adequate ventilation Inadequate ventilation can result in hazardous levels of combustion products and inadequate oxygen levels for breathing Odor is not adequate to warn of hazardous conditions

The standards for "coal tar pitch volatiles, as benzene solubles" are based upon coal coking, not upon petroleum-derived oils However, in 29 CFR 1910.1200.1002, OSHA has defined "coal tar pitch volatiles" to include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood and other organic matter Accordingly, the coal tar pitch volatile standard may apply to the aerosol form of this material

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)	TWA 100 (mg/M ³) from ACGIH (TLV) [Proposed for 2001] - SKIN
2) Biphenyl (Diphenyl)	TWA 0.2 (ppm) from ACGIH (TLV) [2000] TWA 0.2 (ppm) from OSHA (PEL) [1989]
3) Oil mist, mineral	TWA 5 STEL 10 (mg/M ³) from ACGIH (TLV) [2000] TWA 5 (mg/M ³) from OSHA (PEL) [1976]
4) Coal tar pitch volatiles, as benzene solubles ("A1" Confirmed Human Carcinogen)	TWA 0.2 (mg/M ³) from ACGIH (TLV) [2000] TWA 0.2 (mg/M ³) from OSHA (PEL) [1989]
5) Oil mist, mineral, sum total of 15 PAHs listed as carcinogens by US NTP	TWA 0.005 (mg/M ³) from ACGIH (TLV) [Proposed for 2001]

Light Gas Oil

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Transparent to opaque, slightly pale to yellow	Odor	Characteristic, heating oil-like
Specific Gravity	0.88 to 0.90 at 60°F (Water = 1)	pH	Not applicable	Vapor Density	5.5 to 10.0 (Air = 1 at 70°F)
Boiling Point/Range	230° to 413°C (446° to 775°F) (ASTM D-86)	Melting/Freezing Point			1° to 7°C (34° to 45°F) (ASTM D-97)
Vapor Pressure	0.1 to 0.4 Reid-psi at 38°C (100°F)	Viscosity (cSt @ 40°C)			7.35 to 11.75 (ASTM D-445)
Solubility in Water	Negligible to slightly soluble in cold water (0.001 to 0.02%)	Volatile Characteristics			Slight, no Volatile Organic Compounds (VOCs) present at 400°F (204°C)
Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 58.5 to 80 Wt % (ASTM D-1319), C12-C30 Aromatic Hydrocarbon Content = 20 to 41.5 Wt % (ASTM D-1319), Average Density at 60°F = 7.411 lbs/gal (ASTM D-2161), Cetane Number = GT 40 (ASTM D-613 or D-976), Saybolt Viscosity = 50 to 65 SUS at 100°F (ASTM D-2161), Sulfur Content = LT 0.5 Wt % (by ASTM D-2622), 90% Boiling Point Temperature = 734° to 752°F (390° to 400°C) (ASTM D-86), Evaporation Rate = LT 0.01 when n-Butyl acetate = 1.0				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	Composition suggests that sulfur compounds might be generated, but, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Straight-run Middle Distillate and Light Paraffinic Distillate (Petroleum) [similar materials]
	GAS (LC50): Acute. 1.72 to 1.82 mg/L for 4 hours [Male Rat]
	ORAL (LD50) Acute GT 5,000 mg/kg [Rat screen] - Diarrhea, hypoactivity, and somnolence
	DERMAL (LD50). Acute. GT 2,000 mg/kg [Rabbit screen]
	BUEHLER DERMAL Acute Non-sensitizing [Guinea Pig].
	INTRAVENOUS (LD50) Acute: 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma
	28-Day DERMAL Subchronic: Minimal to moderate irritation at 200 to 2,000 mg/kg with no other treatment-related clinical effects observed
	Biphenyl (Diphenyl or 1,1'-Biphenyl)
	GAS (TCLo) Acute. 4,400 ug/m ³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting.
	ORAL (LD50): Acute: GT 2,600 mg/kg [Cat screen]
	ORAL (LD50) Acute 2,400 mg/kg [Rat and Rabbit]
	ORAL (LD50) Acute 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea
	DERMAL (LD50) Acute GT 5,010 mg/kg [Rabbit screen]
	INTRAVENOUS (LD50) Acute 56 mg/kg [Mouse]

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 700°F., commonly referred to as "middle distillates, including light vacuum gas oil" have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Untreated and vacuum distillates including light vacuum gas oil have been identified as skin carcinogens by IARC. These similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Light Gas Oil

Untreated (straight-run and vacuum) middle distillates and light gas oils produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) assay, the in-vivo mouse SCE assay, and the in-vivo rat bone marrow cell chromosome aberrations assay; however, the in-vitro mouse lymphoma assay with and without S9 activation produced both mixed positive and negative responses. The significance of these animal study results to human health is unclear.

Studies with mice and rats have shown that some petroleum middle distillate fuels similar to this material have caused liver tumors and kidney damage and/or tumors. However, the kidney effects were sex hormone dependent and not seen in similar studies involving Guinea pigs, dogs, or monkeys. Also, the significance of the liver tumors in rodents is highly speculative relative to humans.

Studies with mice and rats have also shown that chronic exposures (8 hours/day, 7 days/week, for 24 months) to unfiltered diesel fuel exhaust produced lung tumors and lymphomas. On the basis of these studies, NIOSH recommended that complete diesel exhaust be regarded as a "potential carcinogen".

Numerous epidemiology studies have been carried out to test the hypothesis that lung and/or bladder cancers are associated with chronic exposure to diesel engine exhaust. The most comprehensive case-control and retrospective cohort studies on U.S. railroad workers showed an increased risk for lung cancer and this risk significantly increased with extended duration exposures. There are some indications that an elevated frequency of bladder cancer amongst bus and truck drivers may be due to diesel engine exhaust exposure.

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage. Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this intermediate distillate, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, a volatile aromatic hydrocarbon component (biphenyl) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalius cephalus*), similar middle distillates and one of this material's components showed a 96-hour TL_{Ms} (Median Toxic Limit) of from 5 ppm to 20 ppm in ambient saltwater. Also, 96-hour LC₅₀ testing produced results from 20 ppm to 320 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Banded Killifish (*Fundulus diaphanus*), American Eel (*Anguilla rostrata*), White Perch (*Perca fluviatilis*), and Striped Mullet (*Mugil cephalus*). Based upon actual spill incident investigations, similar middle distillates and oils containing polynuclear aromatic hydrocarbon compounds similar to this material were shown to bioaccumulate in tissues of various fish and other aquatic organisms from less than 1 to 10 ppm levels.

Environmental Fate

This middle distillate is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

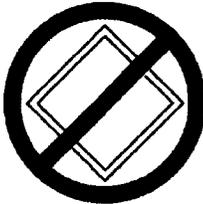
Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Light Gas Oil

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is not regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum oil, N O I B N		
Hazard Class	Not a DOT controlled material	Packing Group(s)	Not applicable
		UNNA ID	Not applicable
Reportable Quantity	Not applicable		
Picards		Emergency Response Guide No.	Not applicable
		HAZMAT STCC No.	Not applicable
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) Health Hazard and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following component in concentrations which might be at or above de minimis levels and are listed as a toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Biphenyl (Diphenyl) [CAS No. 92-52-4] concentration: 0 to 1.5%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance present in this material subject to this statute is: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] (RQ = 100 lbs. [45.36 kg]) conc.: 0.001 to 0.003%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

HoustonRefining

A Lyondell Company

Light Gas Oil

**California
Proposition 65**

This material, especially if it is used as a fuel, contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it might be subject to requirements of California Health & Safety Code Section 25249.5:
Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9]
Diesel Engine Exhaust (following combustion)

**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2

**Additional Regulatory
Remarks**

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component of this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare" **Biphenyl (Diphenyl) [CAS No. 92-52-4]**.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION Logo and Manufacturer name change.
Version Number 3.1
Revision Date 11/01/06

ABBREVIATIONS

AP = Approximately EQ = Equal > = Greater Than < = Less Than NA = Not Applicable ND = No Data NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association
IARC = International Agency for Research on Cancer NTP = National Toxicology Program
NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration
NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System
NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

HoustonRefining

A Lyondell Company

Heavy Straight-run NaphthaAP0884
HFR #230**Material Safety Data Sheet****Company**Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583MSDS No. AP0884
Revision Date 11/01/06**IMPORTANT:** Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.**Emergency Overview**

Physical State	Liquid.		
Color	Transparent, clear to slightly yellow.	Odor	Moderate, sweet and pleasant, aromatic hydrocarbon to gasoline-like.

WARNING! Flammable liquid; vapor may cause flash fire!
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!
Liquid contact may cause mild to severe eye and/or moderate to severe skin irritation and inflammation!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects such as hearing loss!
May be harmful or fatal if ingested!
Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
May adversely affect reproduction or reproductive development!
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective EquipmentMinimum Requirements
See Section 8 for Details**SECTION 1: IDENTIFICATION**

Trade Name	Heavy Straight-run Naphtha
Product Number	3229232292
CAS Number	64741-41-9
Product Family	C7-C12 Petroleum Hydrocarbons
Synonyms	Xylene Reformer Feed (XRF); Heavy Straight-run Naphtha (Petroleum); HSRN; Crude Still Heavy Gasoline or Naphtha; Untreated Heavy Gasoline; Crude Tower Naphtha; Crude Tower Gasoline-Cut Side Stream; 733 Unit Light Ends Fractionator (LEF) Bottoms; 631 HDS Unit Feedstock; 735 Magnaformer Feedstock.

Business Contact

Product Safety 800-700-0946

24 Hour Emergency Contact

CHEMTREC	800-424-9300
CANUTEK-Canada	613-996-6666
LYONDELL	800-245-4532

Heavy Straight-run Naphtha

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Heavy Straight-run Naphtha (Petroleum)	64741-41-9	100
2) Heptanes	Mixture	1-10
3) Methylcyclohexane	108-87-2	1-3
4) Toluene	108-88-3	1-5
5) C7-C12 alpha-Alkenes	68855-57-2	1-10
6) Octanes	Mixture	15-25
7) Xylenes, Mixed Isomers	1330-20-7	5-20
8) Ethylbenzene	100-41-4	1-5
9) Nonanes	Mixture	10-25
10) Cumene	98-82-8	1-5
11) n-Propylbenzene	103-65-1	0.5-1.5
12) Trimethylbenzene (mixed isomers)	25551-13-7	5-10
13) 1,2,4-Trimethylbenzene (Pseudocumene)	95-83-6	2-6
14) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-10
15) Indene	95-13-6	0.5-1.5
16) Naphthalene	91-20-3	0.5-1.5
17) C10-C12 Alkylbenzenes	70693-06-0	5-10
18) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	5-10

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this product can cause mild to severe eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials suggest that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this product may be harmful or fatal.

Heavy Straight-run Naphtha

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IB Flammable Liquid. Highly flammable!		
Flash Point Method	CLOSED CUP: -4° to 4°C (25° to 40°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 0.9 %	Upper Flammable Limit	AP 7.0 %
Autoignition Temperature	AP 232°C (450°F) (ASTM E-659)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors including oxides of sulfur and nitrogen.		
Special Properties	Flammable Liquid! This material releases vapors at or well below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

Heavy Straight-run Naphtha

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Heavy Straight-run Naphtha

- Body Protection** Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
- Respiratory Protection** For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).
- General Comments** Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Gasoline ("A3" Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 500 (ppm) from OSHA (PEL) [1989]
2) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
3) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
4) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) [1999] TWA: 400 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
5) Toluene ("A4" = Not Classifiable)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
6) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
7) Xylene, Mixed Isomers ("A4" = Not Classifiable)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989]
8) Ethylbenzene ("A4" = Not Classifiable)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [1989]
9) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) [1999] TWA: 200 (ppm) from OSHA (PEL) [1989]
10) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) [1999] TWA: 25 (ppm) from OSHA (PEL) [1989]
11) Cumene	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 50 (ppm) from OSHA (PEL) [1989] - SKIN
12) Indene	TWA: 10 (ppm) from ACGIH (TLV) [1999] TWA: 10 (ppm) from OSHA (PEL) [1989]
13) Naphthalene ("A4" = Not Classifiable)	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [1989] TWA: 10 (ppm) from OSHA (PEL) [1976]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, clear to slightly yellow.	Odor	Moderate, sweet and pleasant, aromatic hydrocarbon to gasoline-like.
Specific Gravity	0.83 to 0.85 (Water = 1)	pH	Not applicable.	Vapor Density	3.5 to 3.9 (Air = 1)
Boiling Point/Range	82° to 235°C (180° to 455°F) (ASTM D-86)	Melting/Freezing Point			LT -46°C (-50°F)
Vapor Pressure	3.0 to 3.5 Reid-psia at 38°C (100°F).	Viscosity (cSt @ 40°C)			1 to 3
Solubility in Water	Soluble in methanol and diethyl ether. Slightly soluble in cold water (LT 0.1%).	Volatile Characteristics			Volatile Organic Compounds (VOCs) Content = 100%; 800 to 900 gm/L.

Heavy Straight-run Naphtha

Additional Properties Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 30 to 79 Wt.% (ASTM D-1319);
 C6-C12 Aromatic Hydrocarbons Content = 20 to 80 Wt.% (ASTM D-1319);
 Olefin Hydrocarbons Content = 1 to 10 Wt.% (ASTM D-1319);
 Average Density at 60°F = 6.995 lbs./gal. (ASTM D-2500);
 Evaporation Rate = 0.35 to 2.0 when n-Butyl acetate = 1.0;
 Sulfur Content = 0.1 to 0.25 Wt.% (ASTM D-2622, D-1266, or D-1552);
 90% Boiling Point Temperature = 415° to 435°F (213° to 224°C) (ASTM D-86);
 Dry Point Temperature = 450°F (232°C) (ASTM D-86);
 Net Heat of Combustion Value = 18,600 to 20,600 Btu/lb. (ASTM D-1405 or D-2382).

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Heavy Catalytic Cracked and Reformed Naphthas (Petroleum) (similar materials):

ORAL (LD50): Acute: 4,820 to 5,800 mg/kg [Rat] - Somnolence, diarrhea, and hypermotility.
 GAS (LC50): Acute: GT 5,040 mg/L for 4 hours [Rat screen level] - Somnolence.
 DERMAL (LD50): Acute: GT 2,000 mg/kg [Rabbit screen level].

n-Heptane:

GAS (LC50): Acute: 103,000 mg/m³ for 4 hours [Rat] - Convulsions.
 DERMAL (LD50): Acute: GT 2,000 mg/kg [Rabbit].
 INTRAVENOUS (LD50): Acute: 222 mg/kg [Mouse].

Toluene:

ORAL (LD50): Acute: 636 mg/kg [Rat].
 ORAL (LD50): Acute: 4,000 mg/kg [Cat].
 GAS (LC50): Acute: 49,000 mg/m³ for 4 hours [Rat].
 GAS (LC50): Acute: 5,320 ppm for 8 hours [Mouse].
 GAS (LC50): Acute: 400 ppm for 24 hours [Mouse].
 DERMAL (LD50): Acute: 14,100 uL/kg or 12,125 mg/kg [Rabbit].
 INTRAVENOUS (LD50): Acute: 1,960 mg/kg [Rat].
 INTRAVENOUS (LD50): Acute: 2,000 mg/kg [Mouse].
 SUBCUTANEOUS (LD50): Acute: 2,250 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 59 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 500 mg/kg [Guinea Pig].
 INTRAPERITONEAL (LD50): Acute: 1,332 mg/kg [Rat].

Methylcyclohexane:

ORAL (LD50): Acute: 2,250 mg/kg [Mouse].
 GAS (LC50): Acute: 41,500 mg/m³ for 2 hours [Mouse] - Hypermotility and diarrhea.
 GAS (LC50): Acute: 15,227 ppm for 1 hour [Rabbit] - General anesthetic, convulsions, and changes in the salivary glands.

n-Octane:

GAS (LC50): Acute: 118,000 mg/m³ for 4 hours [Rat].

Xylenes:

ORAL (LD50): Acute: 4,300 mg/kg [Rat].
 GAS (LC50): Acute: 4,550 ppm for 4 hours [Rat].
 DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit].
 SUBCUTANEOUS (LD50): Acute: 1,700 mg/kg [Rat].
 INTRAPERITONEAL (LD50): Acute: 2,459 mg/kg [Rat].
 INTRAPERITONEAL (LD50): Acute: 1,548 mg/kg [Mouse].

Ethylbenzene:

ORAL (LD50): Acute: 3,500 mg/kg [Rat].
 DERMAL (LD50): Acute: 17,800 uL/kg [Rabbit].
 INTRAPERITONEAL (LD50): Acute: 2,624 mg/kg [Rat].

Heavy Straight-run Naphtha

n-Nonane:

GAS (LC50): Acute: 3,200 ppm for 4 hours [Rat].
 INTRAVENOUS (LD50): Acute: 218 mg/kg [Mouse].

n-Propylbenzene:

ORAL (LD50): Acute: 6,040 mg/kg [Rat].
 GAS (LC50): Acute: 65,000 ppm for 2 hours [Rat].

Trimethylbenzenes:

ORAL (LD50): Acute: 8,970 mg/kg [Rat].

1,2,4-Trimethylbenzene:

ORAL (LD50): Acute: 5,000 mg/kg [Rat].
 GAS (LC50): Acute: 18,000 mg/m³ for 4 hours [Rat].

Ethylmethylbenzenes (Ethyltoluenes):

GAS (LC50): Acute: 50,000 mg/m³ for 2 hours [Cat].
 GAS (LC50): Acute: 54,000 mg/m³ for 4 hours [Mouse].

Indene:

ORAL (LD50): Acute: 2,300 mg/kg [Rat].
 ORAL (LD50): Acute: 1,800 mg/kg [Mouse].
 GAS (LC50): Acute: 14,000 mg/m³ for 4 hours [Rat].

Naphthalene:

ORAL (LD50): Acute: 490 mg/kg [Rat].
 ORAL (LD50): Acute: 533 mg/kg [Mouse].
 ORAL (LD50): Acute: 1,200 mg/kg [Guinea Pig].
 SUBCUTANEOUS (LD50): Acute: 969 mg/kg [Mouse].
 INTRAVENOUS (LD50): Acute: 100 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 150 mg/kg [Mouse].

Subchronic (28-day) oral and dermal studies with heavy catalytic cracked and reformed naphthas similar to heavy straight-run naphtha (petroleum) using both rats and rabbits showed animal weight loss or reduced weight gain, renal tubule changes and acute tubular necrosis, plus slight to severe skin irritation without sensitization. These similar naphthas also produced equivocal mutagenic responses in the Salmonella/microsome (Ames) Assay and equivocal or positive responses in the in-vitro Mouse Lymphoma Assay with and without S9 activation. The significance of these animal mutagenicity study results to human health is unclear.

Long-term mouse skin painting studies sponsored by the American Petroleum Institute (API) showed heavy catalytic cracked naphtha caused a slight increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). Average latency period was 72 weeks. However, heavy catalytic reformed naphtha did not produce any skin tumors under the same regimen. A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of similar and heavier petroleum distillates.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by inhalation and dermal exposure and repeated direct skin application can produce defatting dermatitis. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic 2,5-heptanedione which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of n-heptane of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a 95% purity n-heptane from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, n-heptane and its metabolites were found in low levels (LT 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Heavy Straight-run Naphtha

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

Heavy Straight-run Naphtha

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay on **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. NTP, IARC, and OSHA have not designated ethylbenzene as a carcinogen.

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Prolonged and/or repeated overexposure to **cumene (isopropylbenzene)** via inhalation or skin absorption can cause liver and/or kidney damage.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Indene and the ethylmethylbenzenes are primary skin irritants and overexposures might cause liver and/or kidney damage or increase blood cholinesterase levels. Inhalation of these and other **C9 aromatic hydrocarbons** by pregnant mice and rats during gestational days 6 through 15 resulted in decreased fetal and newborn weights.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction or red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in 8 of 21 workers exposed to elevated levels of naphthalene vapors for 5 years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Also, naphthalene may cause fetal toxicity or damage. Laboratory studies produced limited evidence of fetal toxicity in pregnant female mice including decreased spleen weights.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Volatile aromatic hydrocarbon components (**toluene, xylenes, ethylbenzene, cumene, indene, trimethylbenzenes, and naphthalene**) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLM (Median Toxic Limit) from 5 ppm to 20 ppm in ambient saltwater. Also, 24-hour and 96-hour TLMs produced results from 60 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), Guppy (*Lebistes reticulatus*) and juvenile American Shad (*Squalius cephalus*) in fresh water. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Octanes, Nonanes)		
Hazard Class	Class 3: Flammable liquid.	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this material which might require DOT HAZMAT bill-of-lading display are Xylenes and Toluene and/or Ethylbenzene .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Component analysis might define this product as a DOT "Marine Pollutant" per 49 CFR 171.8 (Cumene, Trimethylbenzenes, Ethylmethylbenzenes, and Naphthalene).

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.

HoustonRefining

A Lyondell Company

Heavy Straight-run Naphtha

SARA 313

This material might contain the following components in concentrations at or above de minimis levels and they are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313:

Toluene [CAS No. 108-88-3] concentration: 1 to 5%
Xylenes [CAS No. 1330-20-7] concentration: 5 to 20%
Ethylbenzene [CAS No. 100-41-4] concentration: 1 to 5%
Cumene (Isopropylbenzene) [CAS No. 92-82-8] concentration: 1 to 5%
1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 95-63-6] concentration: 2 to 6%
Naphthalene [CAS No. 91-20-3] concentration: 0.5 to 1.5%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are:

Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0 to 0.001%
Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5%
2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 0.15 to 2.5%
Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 5 to 20%
Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5%
Cumene (Isopropylbenzene) [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 1 to 5%
Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.5 to 1.5%.

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material might contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5:
Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].

New Jersey Right-to-Know Label

For New Jersey labeling refer to components listed in Section 2.

Additional Regulatory Remarks

Under Section 12(b) of TSCA: Because it contains detectable amounts of **Cumene (Isopropylbenzene) [CAS No. 98-82-8], n-Propylbenzene [CAS No. 103-65-1], and other C9 Aromatic Hydrocarbons**, this material might be subject to US EPA's one-time only per country export notification requirements.

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a from suitable for use in the household or by children. Precautionary label dialogue should display the following:
Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Benzene [CAS No. 71-43-2], Methylcyclohexane [CAS No. 108-87-2], Toluene [CAS No. 108-88-3], Xylenes [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], and Cumene [98-82-8].**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION	Logo and Manufacturer name change.
Version Number	7.1
Revision Date	11/01/06

Heavy Straight-run Naphtha

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



MATERIAL SAFETY DATA SHEET

COKER NAPHTHA

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

AP0885
 HFR# 2,4,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: COKER NAPHTHA

Number: 000000000000017843

Internal ID: AP0885

Chemical characterization: Mixture

CAS-No.: 68513-02-0

Chemical Name: Hydrocarbons and additives

Synonyms: Full-range Coker Naphtha (Petroleum), Full-range Thermal Cracked Naphtha, Delayed Coker Unit Naphtha, Naphtha From a Delayed Coker Unit, Thermocracked Gasoline, 736 and 737 Units' Naphtha or Gasoline, 736 Unit T-106 and 737 Unit Debutanizer Bottoms, Feed to Depentanizer Splitter Tower, C4-C10 naphtha, C4-C10 Petroleum Hydrocarbons

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

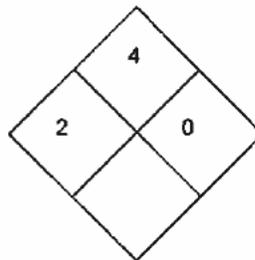
Signal Word

DANGER.

Hazards

Aspiration hazard. May be harmful if inhaled, swallowed or absorbed through the skin. This material also contains components that may cause hearing loss and may be a developmental toxin. Toxic to the nervous system. Possible cancer hazard.

NFPA®



HMIS®

Health	*	2
Flammability		4
Physical Hazard		0

Physical state

liquid



MATERIAL SAFETY DATA SHEET

MSDS No.: BE96
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Color

colorless to light yellow

Odor

slight Hydrocarbon.

Odor Threshold

No value available.

Potential health effects

Routes of exposure

Eye. Skin. Inhalation.

Acute effects

Inhalation hazard. May cause drowsiness and dizziness.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *n-Pentane 109-66-0*

Aspiration hazard. May cause central nervous system depression.

- *Xylene 1330-20-7*

May be irritating to the eyes, skin, and respiratory system. Aspiration hazard. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Ethyl alcohol 64-17-5*

May cause eye and upper respiratory tract irritation. Short-term overexposure above 1,000 ppm by the inhalation route may cause central nervous system (CNS) effects such as headache and irritation of eyes, nose and throat. If continued for more than an hour additional CNS effects may occur such as: dizziness, drowsiness, loss of appetite, and an inability to concentrate. Gastrointestinal (stomach) effects may occur with symptoms such as nausea and vomiting.

- *n-Hexane 110-54-3*

May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. May be irritating to the skin. High or repeated exposures can damage the peripheral nervous system, causing numbness, tingling, and/or muscle weakness in the hands or feet. The onset of health effects associated with n-hexane may be influenced by exposure to additional chemicals such as methyl isobutyl ketone and methyl ethyl ketone.

- *Methyl Cyclohexane 108-87-2*

Liquid, mist, or vapors can cause eye, skin and respiratory tract irritation. CNS depressant. Exposure to excess vapor may cause headache, fatigue, drowsiness and dizziness.

- *Trimethyl benzene 25551-13-7*

CNS depressant. Aspiration hazard.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Cumene 98-82-8*

Slight eye irritant. Slight skin irritant. Aspiration hazard. CNS depressant.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *Cyclohexane 110-82-7*

CNS depressant. Simple asphyxiant. May be irritating to the eyes, skin, and respiratory system.

- *Naphthalene 91-20-3*

May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus.

- *Methylcyclopentane 96-37-7*



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

This product may cause eye, skin, and respiratory tract irritation. High concentrations may cause central nervous system (CNS) depression. Ingestion would likely cause gastrointestinal tract irritation.

- *Indene 95-13-6*

May cause drowsiness and dizziness. Aspiration into the lungs may cause chemical pneumonia.

Skin

May produce skin irritation. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis. May be absorbed through the skin and produce toxic effects such as CNS depression. Repeated or prolonged skin contact may result in allergic dermatitis. If the skin is damaged, absorption increases.

Inhalation

Can cause pulmonary edema if aspirated into lungs. High concentrations can displace oxygen and cause drowsiness, dizziness, unconsciousness and/or suffocation by asphyxiation. Exposure may cause symptoms of lack of oxygen, leading to collapse and death. Inhalation of vapors may cause respiratory distress and CNS effects.

Eyes

May cause moderate irritation, including burning sensation, tearing, redness or swelling. Effects of eye irritation are reversible.

Ingestion

Aspiration may cause lung damage. Irritates mucous membranes of the mouth, throat, and esophagus and is readily absorbed by the stomach and intestinal tract. CNS symptoms include nausea, vomiting, pallor, dizziness, staggering gait, drowsiness, shallow rapid pulse, loss of consciousness, and delirium prior to the onset of convulsions, coma, and death. Ingestion and/or vomiting of this material may result in aspiration into the lungs. Even a small amount of this liquid entering the lungs can produce potentially fatal effects (pulmonary edema and pneumonitis). Solid and liquid forms of this material and the pressurized gas can cause freeze burn.

Chronic effects

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. Prolonged or repeated exposure to vapors may cause lung damage. May affect hearing. Suspect reproductive hazard. May cause developmental toxicity. Contains material which may cause cancer based on animal data.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *n-Pentane 109-66-0*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin.

- *Xylene 1330-20-7*

May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard.

- *Ethyl alcohol 64-17-5*

Long-term exposure can also cause loss of appetite, weight loss, nervousness, memory loss, mental retardation and liver damage. May cause dermatitis by defatting the skin from prolonged or repeated contact. Alcoholic beverages are carcinogenic to humans. Ethanol is a developmental toxin and various effects have been associated with ethanol intake. Examples of chronic ethanol abuse effects include physical dependence, malnutrition, amnesia, dementia, somnolence, cardiac myopathy, hepatotoxicity, GI bleeding and pancreatitis. Combined exposure to ethanol and certain other chemicals may result in increased toxic effects.

- *n-Hexane 110-54-3*

Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Prolonged and repeated exposure to vapors may cause damage to the CNS, lungs and kidneys. Suspect reproductive hazard.

- *Methyl Cyclohexane 108-87-2*

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

- *Trimethyl benzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *Benzene 71-43-2*



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Cumene 98-82-8*

This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans). Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. May cause kidney and/or lung damage.

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *Cyclohexane 110-82-7*

No adverse chronic human health effects have been reported for this material.

- *Naphthalene 91-20-3*

Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Potential Cancer Hazard, see section 11.

- *Methylcyclopentane 96-37-7*

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

- *Indene 95-13-6*

No known chronic health effects.

Aggravated Medical Condition

Pre-existing medical conditions including dermatitis, diseases of the lungs, kidneys, liver, heart, nervous system or the blood. Women of child bearing potential should avoid contact with this material. Any pre-existing disorders or diseases of the: liver blood

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Gasoline	86290-81-5	289-220-8	85.0 <= 100.0
Toluene	108-88-3	203-625-9	1.0 <= 20.0
n-Pentane	109-66-0	203-692-4	5.0 <= 20.0
Xylene	1330-20-7	215-535-7	1.0 <= 18.0
Ethyl alcohol	64-17-5	200-578-6	0.0 <= 10.0
n-Hexane	110-54-3	203-777-6	1.0 <= 8.0
Methyl Cyclohexane	108-87-2	203-624-3	1.0 <= 5.0
Trimethyl benzene	25551-13-7	247-099-9	1.0 <= 5.0
Benzene	71-43-2	200-753-7	0.1 <= 5.0
Cumene	98-82-8	202-704-5	0.5 <= 4.0
Ethyl Benzene	100-41-4	202-849-4	0.2 <= 4.0
Cyclohexane	110-82-7	203-806-2	1.0 <= 3.0
Naphthalene	91-20-3	202-049-5	0.1 <= 2.0
Methylcyclopentane	96-37-7	202-503-2	1.0 <= 2.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Indene

95-13-6

202-393-6

0.5 <= 1.5

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. Never use low boiling point naphthas for washing contaminated skin. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation. Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist. If eye tissue is frozen, seek medical attention immediately. If tissue is not frozen, thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persists seek medical attention.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Never give anything by mouth to an unconscious person. Immediately seek medical attention.

Notes to physician

Treat symptomatically. Inhalation may cause CNS depression. Overexposure may produce anesthetic or narcotic effects. Do not induce vomiting. Risk of damage to lungs exceeds poisoning risk. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of pulmonary/upper airway edema. Provide 100% humidified supplemental oxygen with assisted ventilation if needed. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Gastric lavage may also be indicated. Airway protection may be necessary.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

Extremely flammable liquid. OSHA/NFPA Class IA flammable liquid.

Flash point



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Flash point

-30 °C (-22 °F)

Autoignition temperature

~ 232 °C (449.6 °F)

Lower explosion limit

~ 1.1 vol%

Upper explosion limit

~ 7.6 vol% (% vol in air).

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Dry chemical. CO₂. Water spray. Foam. Sand. LARGE FIRES: Water spray. Water fog. Foam. Dry chemical. CO₂. Sand.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

When exposed to ignition source in air, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. Releases flammable vapors below normal ambient temperatures. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Prevent fire extinguishing water from contaminating surface water or the ground water system. When fighting a fire, notify environmental authorities if liquid enters sewers or public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon monoxide and other toxic vapors.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Release causes immediate fire/explosion hazard. Limit access to essential personnel. Eliminate all sources of ignition. Let evaporate. If possible, turn leaking container so that gas escapes rather than liquid. Do not direct water at spill or source. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas. Do not direct water at spill or source of leak. Liquid spills will vaporize forming cold dense vapor clouds that do not readily disperse. Avoid vapor cloud even with proper respiratory equipment. A vapor suppressing foam may be used to reduce vapors. Caution: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning. Stop leak if you can do it without risk. Stop source of release with non-sparking tools before beginning clean-up or fire extinguishing. All equipment used when handling this product must be grounded. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Evacuate all non-essential personnel to an area upwind (at least 1/2 mile in all directions if tanks or tank cars are involved in in fire or spill). Evacuate/limit access.

If the product contaminates rivers and lakes or drains inform respective authorities.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

7. HANDLING AND STORAGE

Handling

Electrostatic charge may build up during handling. Equipment should be grounded and bonded. During transfer of product, ground container and insure that all conveying equipment is properly grounded. Always keep nozzle in contact with the container throughout the loading process. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Electrostatic charges may be generated as a result of flow or agitation. Use only non-sparking tools. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. Keep container closed and drum bungs in place. Store away from heat, sparks, open flames, strong oxidizing agents and direct sunlight. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of U.S. national electrical code, U.S. National Fire Protection Agency (NFPA). Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Never siphon by mouth. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Ensure adequate ventilation, especially in confined areas. Eliminate all sources of ignition. Spilled material can make walking hazardous, potentially causing falls and serious injury. Do not breathe vapor. Avoid contact with skin. Do not smoke. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Use good housekeeping practices during use, storage, transfer, and handling.

Storage

Store only in tightly closed, properly vented containers away from heat, sparks, open flame and strong oxidizing agents. Store closed drums with bung in up position. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Electrical installations / working materials must comply with the technological safety standards. Keep container tightly closed and properly labeled. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Store and transport in accordance with all applicable laws.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. Use adequate ventilation to keep vapor concentrations below applicable exposure limit(s). Local exhaust in addition to general room ventilation may be required to meet exposure limit(s). If mechanical ventilation is used, electrical systems should conform to U.S. National Electric Code. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

Appropriate respiratory protection where atmosphere exceeds recommended limits. If exposure may exceed the exposure limit(s), use respiratory equipment recommended or approved by appropriate local, state or international agency. Use appropriate respiratory protection where atmosphere exceeds recommended limits.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Gasoline	US (ACGIH)	STEL	500 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

	US (ACGIH)	STEL	500 ppm	None.
	US (ACGIH)	TWA	300 ppm	None.
	US (ACGIH)	TWA	300 ppm	None.
Toluene	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.
n-Pentane	US (ACGIH)	TWA	600 ppm	None.
	US (OSHA)	TWA	1,000 ppm 2,950 mg/m ³	None.
	NIOSH	IDLH	1,500 ppm	None.
Xylene	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
Ethyl alcohol	US (ACGIH)	STEL	1,000 ppm	None.
	US (OSHA)	TWA	1,000 ppm 1,900 mg/m ³	None.
	NIOSH	IDLH	3,300 ppm	None.
n-Hexane	US (ACGIH)	TWA	50 ppm	None.
	US (OSHA)	TWA	500 ppm 1,800 mg/m ³	None.
	NIOSH	IDLH	1,100 ppm	None.
Methyl Cyclohexane	US (ACGIH)	TWA	400 ppm	None.
	US (OSHA)	TWA	500 ppm 2,000 mg/m ³	None.
	NIOSH	IDLH	1,200 ppm	None.
Trimethyl benzene	US (OSHA)	TWA	25 ppm	None.
	US (ACGIH)	TWA	25 ppm	None.
Benzene	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
	NIOSH	IDLH	500 ppm	None.
Cumene	US (ACGIH)	TWA	50 ppm	None.
	US (OSHA)	TWA	50 ppm 245 mg/m3	None.
	NIOSH	IDLH	900 ppm	None.
Ethyl Benzene	US (ACGIH)	STEL	125 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m3	None.
	NIOSH	IDLH	800 ppm	None.
Cyclohexane	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	300 ppm 1,050 mg/m3	None.
	NIOSH	IDLH	1,300 ppm	None.
Naphthalene	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	US (OSHA)	TWA	10 ppm 50 mg/m3	None.
	NIOSH	IDLH	250 ppm	None.
Indene	US (ACGIH)	TWA	5 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid colorless, to, light yellow



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Odor: slight Hydrocarbon.

Odor Threshold: No value available.

pH: not applicable

Boiling point/boiling range: 20 - 350 °C (68 - 662 °F)

Melting point/freezing point: No Data Available.

Flash point: -30 °C (-22 °F)

Autoignition temperature: ~ 232 °C (449.6 °F)

Flammability: Extremely flammable liquid. OSHA/NFPA Class IA flammable liquid.

Lower explosion limit: ~ 1.1 vol%

Upper explosion limit: ~ 7.6 vol% (% vol in air).

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: 10 - 20 kPa

Evaporation rate: No Data Available.

Relative density: 0.65 - 0.88 @ 15 °C (59 °F)

Relative vapor density: not determined

Viscosity: < 1 mm²/s @ 37.8 °C (100.04 °F)

Water solubility: 0.03 - 0.1 g/l

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

This product is normally stable. The product is stable.

Conditions to avoid

Heat, sparks, open flames and strong oxidizing conditions. Heat, sparks, open flames and strong oxidizing conditions.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Incomplete combustion can result in the production of carbon monoxide, carbon dioxide and other toxic gases.

Hazardous polymerization

Not expected to occur. Not expected to occur.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Inhalation of high vapor concentrations can cause CNS-depression and narcosis. Inhalation of vapors in high concentration may cause shortness of breath (lung edema). Solvents may degrease the skin. This product contains benzene. Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact. Benzene can destroy blood-forming cells in the bone marrow and is associated with leukemia and possibly other cancers. This material also contains components that may cause hearing loss and may be a developmental toxin. Toluene has known developmental toxicity. Suspect reproductive hazard - contains material which may injure unborn child. Suspect reproductive hazard. Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. The NTP has found that Cumene causes increased incidences of combined benign and malign kidney tumors in male rats, and malignant lung tumors in mice of both sexes.

Acute toxicity

<u>LC50 (Inhl)</u>	rat	>5.61	4 HOURS
<u>LD50 (Skin)</u>	rabbit	>2000 MG/KG	

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Inhalation may cause CNS depression. Can cause pulmonary edema if aspirated into lungs.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Skin

Irritating to skin.

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Skin. Central nervous system. Blood. central nervous system (CNS) Liver. Kidneys.

Repeated dose toxicity

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Genetic Toxicity

Mutagenic Substance. May cause genetic defects. Stream expected to be mutagenic based on toxicity information for



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

components present in this stream.

Carcinogenicity

May cause cancer. Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream.

Other information

This product contains benzene. Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact. Contains xylene(all isomers). May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard. Ethyl alcohol May cause eye and upper respiratory tract irritation. Short-term overexposure above 1,000 ppm by the inhalation route may cause central nervous system (CNS) effects such as headache and irritation of eyes, nose and throat. If continued for more than an hour additional CNS effects may occur such as: dizziness, drowsiness, loss of appetite, and an inability to concentrate. Gastrointestinal (stomach) effects may occur with symptoms such as nausea and vomiting. Long-term exposure can also cause loss of appetite, weight loss, nervousness, memory loss, mental retardation and liver damage. May cause dermatitis by defatting the skin from prolonged or repeated contact. Alcoholic beverages are carcinogenic to humans. Ethanol is a developmental toxin and various effects have been associated with ethanol intake. Examples of chronic ethanol abuse effects include physical dependence, malnutrition, amnesia, dementia, somnolence, cardiac myopathy, hepatotoxicity, GI bleeding and pancreatitis. Combined exposure to ethanol and certain other chemicals may result in increased toxic effects. Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye. Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity. n-hexane May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Suspect reproductive hazard. naphthalene. May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus. cumene Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. May cause kidney and/or lung damage. May cause cancer. Ethyl benzene May effect hearing. Repeated or prolonged exposure may cause severe irritation of the nose, throat and lungs, as well as liver and kidney damage. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

COMPONENT INFORMATION

- *Gasoline* 86290-81-5

Other information

See Product Summary

- *Toluene* 108-88-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight, increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *n*-Pentane 109-66-0

Acute toxicity

<u>LC50 (Inh)</u>	rat	> 18.02 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	> 2000 MG/KG BWT	
<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	

Target Organs



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Target Organs

Respiratory system. Kidneys.

Repeated dose toxicity

No treatment-related effects were observed in a 90-day inhalation study in rats exposed to n-pentane at up to 6778 ppm (20 mg/L). Inhalation neurotoxicity evaluations in rats exposed to n-pentane at 3000 ppm (8.9 mg/L) for up to 30 weeks found no evidence of neurotoxicity. Repeated oral gavage exposures of rats to 500 mg/kg bwt/day n-pentane produced lethality, decreases in bodyweight gain and slightly lower kidney weights.

Reproductive effects

No effects on reproductive organs were observed in a 90-day inhalation study in rats exposed to n-pentane at ~7000 ppm (20 mg/L). n-Pentane was negative in a dominant lethal test in mice when males were given a single intraperitoneal injection of 48-666 mg/kg bwt.

Developmental Toxicity

No developmental toxicity was observed when pregnant rats were exposed to n-pentane by oral administration of 1000mg/kg bwt/day or by inhalation of 10000 ppm (29.5 mg/L).

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Xylene 1330-20-7*

Acute toxicity

<u>LC50 (Inh)</u>	rat	5000 PPM	4 HOURS
	mouse	3907 MG/KG	6 HOURS
	rat	4550 PPM	4 HOURS

LD50 (Oral) rat 4300 MG/KG

LD50 (Skin) rabbit >1700 MG/KG

Irritation

Skin

Moderate skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

This material is expected to be a mild eye irritant. Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Target Organs

Skin. Eye. central nervous system (CNS)

Repeated dose toxicity

Repeated inhalation exposures of rats to xylenes cause liver effects at 920 ppm (4.0 mg/L) and ototoxicity at \geq 800 ppm (3.48 mg/L). Repeated oral exposures to xylenes produce reductions in body weight in male rats at 500 mg/kg bwt/day; liver effects and hyaline droplet formation in male rats at \geq 150 mg/kg bwt/day; kidney effects in male and female rats at \geq 750 mg/kg bwt/day; and a reduction in bodyweight gain in male mice at \geq 250 mg/kg bwt/day. Repeated inhalation exposures of gerbils to \geq 160 ppm (0.70 mg/L) xylenes cause apparently irreversible CNS effects.

Reproductive effects

A reproductive toxicity study, two dominant lethal studies, and evaluation of reproductive organs in repeated dose studies indicate that xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at non-anesthetic doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

Results from animal studies demonstrate that xylenes may cause reduced fetal weight and delayed ossification, but not malformations, at inhalation dose levels causing no or only slight maternal toxicity (\geq 115 ppm or 0.5 mg/L). Slight neurobehavioral effects were noted in offspring of rats exposed to 500 ppm (2.2 mg/L) in the absence of maternal toxicity.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

- *Ethyl alcohol* 64-17-5

Acute toxicity

<u>LD50 (Oral)</u>	rat	10470 MG/KG BWT
<u>LDLo (Oral)</u>	Human	1400 MG/KG BWT

Irritation

Skin

Standard Draize skin test (rabbit) - Dose: 20 mg/24 hrs Reaction: Moderate Repeated exposure may cause skin dryness or cracking.

Eyes

Eye exposure to Ethanol generally causes transient pain, irritation, and reflex lid closure. A foreign-body sensation may persist for one to two days. Vapors produce transient stinging and tearing, but no apparent adverse effects. Transiently impaired preception of color may occur with acute ingestion or chronic alcoholism. Standard Draize eye test (rabbit) - Dose: 500 mg Reaction: Severe Dose: 500 mg/24 hrs Reaction: Mild

Repeated dose toxicity

Exposure to over 1000 ppm may cause headache, drowsiness and lassitude, loss of appetite, inability to concentrate and irritation of the throat.

Reproductive effects

Excessive consumption of alcoholic beverages during pregnancy can cause fetal alcohol syndrome. The development of physical and mental manifestation in the offspring; it may also cause defects in the central nervous system, heart, kidney and limbs. Moderate consumption can be associated with reduced birthweight and behavioral defects, but effects generally have not been observed with an intake of about one drink per day.

Carcinogenicity

The International Agency for Research on Cancer (IARC) has determined alcoholic beverages are carcinogenic to humans (Group 1) and the occurrence of malignant tumors of the oral cavity, pharynx, larynx, esophagus and liver is causally related to the consumption of alcoholic beverages in humans.

The American Conference of Governmental Industrial Hygienists (ACGIH) lists this substance as an A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans.

- *n-Hexane* 110-54-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	48,000 PPM	4 HOURS
<u>LD50 (Oral)</u>	rat	28,710 MG/KG	
<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	

Irritation

Eyes

Eye irritant.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Peripheral nervous system Testes.

Repeated dose toxicity

Rabbits exposed by inhalation to 3,000 ppm 8 hours/day for 8 days showed changes in the lungs, emphysema, necrosis of the bronchial epithelium, and atelectasis. Rats continuously exposed to 400 ppm developed anoxapathy, although intermittent exposure to 10,000 ppm 6 hours/day, 5 days/week for 13 weeks caused only mild paranodol axonal swelling. The offspring of rats and mice exposed orally or by inhalation to n-hexane during gestation showed depressed weight gain after birth. This agent also affects male and female reproductive capacity.

Reproductive effects

Exposure to n-hexane may damage the developing fetus.

Developmental Toxicity

Causes productive and embryotoxic effects and is cytotoxic in mammalian and human test systems.

Carcinogenicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Not listed by IARC, NTP, OSHA or EPA.

Other information

Exposure of humans to 5,000 ppm n-hexane for 10 minutes causes marked vertigo; exposure to 1,500 ppm results in headache and slight nausea. In industrial settings, exposure to levels exceeding 1,000 ppm have been reported to cause mild symptoms of narcosis. Eye and upper respiratory tract irritation has been reported to occur in humans exposed to 880 ppm n-hexane for 15 minutes. Dermal contact with n-hexane results in immediate irritation characterized by erythema and hyperemia; exposed subjects developed blisters 5 hours following dermal exposure to n-hexane. The neuropathic toxicity of n-hexane in humans is well documented; cases of polyneuropathy have typically occurred in humans chronically exposed to levels of n-hexane ranging from 400 to 600 ppm, with occasional exposures up to 2,500 ppm. Distal symmetrical motor weakness is common in most cases; however, in severely affected individuals, motor weakness may extend to the pelvic and high musculature. Nerve biopsies in affected individuals show swelling of the nerve and thinning of the myelin sheath. Functional neurological disturbances usually progress for a few months after termination of exposure. Although recovery is expected to occur within a year, clinical polyneuropathy has been reported in some cases to remain after 2 years. Blurred vision, restricted visual field, and optic nerve atrophy has been reported to occur in association with n-hexane-induced polyneuropathy.

- *Methyl Cyclohexane* 108-87-2

Acute toxicity

LD50 (Oral) rat > 3,200 MG/KG

Irritation

Skin

May be irritating to the skin. Repeated or prolonged contact with skin may cause dermatitis.

Eyes

May cause eye irritation.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Trimethyl benzene* 25551-13-7

Acute toxicity

LD50 (Oral) rat 8970 MG/KG

Irritation

Skin

Skin irritant.

- *Benzene* 71-43-2

Acute toxicity

rat 13,700 PPM 4 HOURS

rabbit > 8260 MG/KG BWT

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered body weight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Cumene* 98-82-8

Acute toxicity

<u>LC50 (Inhl)</u>	rat	39000 MG/M3	4 HOURS
<u>LD50 (Oral)</u>	rat	1400 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 3160 MG/KG	

Irritation

Skin

Slight skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

Slight eye irritant.

Sensitization

Not expected to be a sensitizer.

Target Organs

Central nervous system. Skin. Eye. Respiratory system. Nasal cavity. Kidney Liver Lungs

Reproductive effects

This substance is not expected to be a reproductive toxicant.

Genetic Toxicity

Negative for genotoxicity using both in vitro and in vivo tests.

Carcinogenicity

The NTP has found that Cumene causes increased incidences of combined benign and malign kidney tumors in male rats,



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

and malignant lung tumors in mice of both sexes. This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans).

- *Ethyl Benzene* 100-41-4

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of \geq 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *Cyclohexane* 110-82-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	13.9 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	> 5000 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 2000 MG/KG	

Target Organs

Central nervous system effects.

Repeated dose toxicity

No known chronic health effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Naphthalene* 91-20-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	>340 MG/M3	4 HOUR
<u>LD50 (Oral)</u>	rat	490 MG/KG	
	mouse	533 MG/KG	
	guinea pig	1200 MG/KG	

Irritation

Skin

May be irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Repeated inhalation or ingestion of naphthalene causes methemoglobinemia*



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Developmental Toxicity

Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bw/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bw/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice).

Genetic Toxicity

Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bw orally or 250 mg/kg bw by intraperitoneal injection.

Carcinogenicity

The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).

- *Methylcyclopentane* 96-37-7

Target Organs

Skin. Eye. Respiratory system. Nervous system.

Repeated dose toxicity

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Indene* 95-13-6

Acute toxicity

LC50 (Inhl) rat 14 GM/M3

Carcinogenicity

Specific data not available.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Toxic to aquatic life with long lasting effects.

Acute Fish toxicity

LL50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 10 mg/l

LL50 / 96 HOURS *Pimephales promelas* (fathead minnow) 8.2 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS *Daphnia magna* (Water flea) 4.5 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 3.1 mg/l

NOELR / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 0.5 mg/l

Toxicity to microorganisms

EC50 / 40 HOURS *Tetrahymena pyriformis* (ciliated protozoa) 15.41 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Chronic toxicity to fish

NOELR / 14 d fish. 2.6 mg/l

Summary: QSAR (Quantitative structure-activity relationship) based calculation predicts low chronic toxicity.

Chronic toxicity to aquatic invertebrates

NOELR / 21 d Daphnia magna (Water flea) 2.6 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Partitioning mainly to air. Environmental releases partition mainly to water.

Predicted distribution to environmental compartments: The product is insoluble and floats on water.

Persistence and degradability

Stability in water: The product is insoluble and floats on water.

Biodegradation: Not expected to be hydrolytically unstable. Not readily, but considered likely to be inherently biodegradable.

Bioaccumulation: This material may bioaccumulate.

COMPONENT INFORMATION

- *Gasoline* 86290-81-5

Ecotoxicity

See product summary.

Environmental fate and pathways

See product summary.

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 55 mg/l

LC50 / 96 HOUR Carassius auratus 22.8 mg/l

LC50 / 96 HOUR Pimephales promelas 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR Daphnia magna. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Chronic toxicity to fish

NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l
 Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY Daphnia magna. 1.0 mg/l

NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *n-Pentane* 109-66-0

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss 4.3 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 9.7 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

Persistence and degradability

Stability in soil: Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Xylene* 1330-20-7

Ecotoxicity

This material is classified as harmful to fish.

Acute Fish toxicity

LC50 / 96 HOUR rainbow trout. 13.5 mg/l

LC50 / 24 HOUR goldfish 13 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Expected to have moderate mobility in soils. Volatilization from moist soil surfaces is expected. Volatilization from dry soil surfaces is expected.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Persistence and degradability

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Ethyl alcohol* 64-17-5

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* (rainbow trout) > 10,000 mg/l

LC50 / 96 HOUR *Pimephales promelas* (fathead minnow) > 13,400 mg/l

Acute toxicity to aquatic invertebrates

/ 48 HOURS *Ceriodaphnia dubia* 5,012 mg/l

/ 24 HOURS *Artemia salina* 858 mg/l

Toxicity to aquatic plants

Growth inhibition / 96 HOURS *Chlorella vulgaris* (Fresh water algae) 1,000 mg/l

Toxicity to microorganisms

Toxicity Threshold / *Pseudomonas putida* 6,500 mg/l

Summary: Inhibition of cell multiplication begins.

Chronic toxicity to aquatic invertebrates

EC10 / 10 d *Ceriodaphnia dubia* 9.6 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Expected to be biodegradable

Bioaccumulation: Bioaccumulation is unlikely.

- *n-Hexane* 110-54-3

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.14 mg/l

LC50 / 96 HOUR *Pimephales promelas* 2.5 mg/l

LC50 / 96 HOURS *Lepomis macrochirus* 4.12 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 3.87 mg/l

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Photolysis, hydrolysis or bioconcentration of n-hexane are not expected to be an important environmental fate processes. Biodegradation of n-hexane may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A Koc range of 1250 to 4100 indicates a low to slight mobility class in soil for n-hexane. In aquatic systems n-hexane may partition from the water column to organic matter contained in sediments and suspended materials. Rapid volatilization from environmental waters is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Methyl Cyclohexane* 108-87-2

Ecotoxicity

This material may be harmful to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR Golden shiner (*notemigonus crysoleucas*) 72 mg/l

Environmental fate and pathways

No Data Available.

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna*. 10 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 32 mg/l

Toxicity to microorganisms

IC50 / 24 HOURS *Nitrosomonas* sp. 13 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Chronic toxicity to fish

LOEC / 32 DAY Pimephales promelas 1.6 mg/l

Chronic toxicity to aquatic invertebrates

NOEC / 7 DAY Ceriodaphnia dubia 3 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for bioaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Cumene* 98-82-8

Ecotoxicity

This material is toxic to fish. It may cause long term adverse effects in the aquatic environment.

Acute Fish toxicity

LC50 / 96 HOURS Pimephales promelas (fathead minnow) 6.04 - 6.61 mg/l

Summary: flow-through test

LC50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 4.8 mg/l

Summary: flow-through test

LC50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 2.7 mg/l

Summary: semi-static test

LC50 / 96 HOURS Poecilia reticulata (guppy) 5.1 mg/l

Summary: semi-static test

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna (Water flea) 0.6 mg/l

EC50 / 48 HOURS Daphnia magna (Water flea) 7.9 - 14.1 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Pseudokirchneriella subcapitata 2.6 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals. It may adsorb onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process. Volatilization from moist soil surfaces is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: This material is expected to be readily biodegradable.

Bioaccumulation: Bioconcentration factor (BCF) ~ 35 BCF ~ 35.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

- *Ethyl Benzene* 100-41-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 / 96 HOUR *Menidia menidia* 5.1 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Cyclohexane* 110-82-7



MATERIAL SAFETY DATA SHEET

MSDS No.: BE96
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Pimephales promelas 4.53 mg/l (flow-through)

LC50 / 96 HOURS Lepomis macrochirus 34.72 mg/l

LC50 / 96 HOURS Poecilia reticulata 48.0 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 400 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Scenedesmus subspicatus > 500 mg/l

Toxicity to microorganisms

EC50 / 5 min Photobacterium phosphoreum 85.5 mg/l

EC50 / 10 min Photobacterium phosphoreum 93 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. It is expected to be poorly adsorbed onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: The potential for volatilization from dry soil surfaces may exist. Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Biodegradation: This material is expected to be resistant to biodegradation.

Bioaccumulation: This material may bioaccumulate.

- *Naphthalene* 91-20-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS rainbow trout. 26 mg/l

Summary: Very toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 21.9 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: Naphthalene has a moderate tendency to bioaccumulate although fish and microorganisms readily metabolize it.

- *Methylcyclopentane* 96-37-7



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Ecotoxicity

No Data Available.

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Volatilization from dry soil surfaces is expected. Volatilization from moist soil surfaces is expected. The estimated BCF value suggests that this material will bioconcentrate in aquatic organisms.

Persistence and degradability

Stability in soil: This material is expected to have slight mobility in soil.

Biodegradation: No relevant studies identified.

Bioaccumulation: Bioconcentration factor (BCF) ~ 2.5 (estimated) Estimated BCF = 2.5

- *Indene 95-13-6*

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

13. DISPOSAL CONSIDERATIONS

Contaminated product, soil, water, and empty containers may be hazardous wastes due to possible presence of flammable gases. Assure emissions comply with applicable regulations. Preferred disposal for this volatile, flammable product is through combustion. Proper grounding procedures to avoid static electricity should be followed. The product should not be allowed to enter drains, water courses or the soil.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Petroleum distillates, n.o.s. (TOLUENE, PENTANE)

Reportable quantity XYLENE
 BENZENE

ID No. UN1268

Hazard class 3

Packing group I

15. REGULATORY INFORMATION



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Canada	DSL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Toluene		1000 lbs
Xylene		100 lbs
n-Hexane		5000 lbs
Benzene		10 lbs
Cumene		5000 lbs
Ethyl Benzene		1000 lbs
Cyclohexane		1000 lbs
Naphthalene		100 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
Toluene	1.0%
Xylene	1.0%
n-Hexane	1.0%
Benzene	0.1%
Cumene	1.0%
Ethyl Benzene	0.1%
Cyclohexane	1.0%
Naphthalene	0.1%

State Reporting

Known to the State of California to cause cancer.

71-43-2	Benzene	(December 11, 2009)
98-82-8	Cumene	(June 14, 2010)
100-41-4	Ethyl Benzene	(December 11, 2009)
91-20-3	Naphthalene	

Known to the State of California to cause birth defects.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

108-88-3 Toluene (December 11, 2009)
 64-17-5 Ethyl alcohol when in alcoholic beverages
 71-43-2 Benzene

Known to the State of California to cause reproductive toxicity in males.

71-43-2 Benzene (December 11, 2009)

Known to the State of California to cause reproductive toxicity in females.

108-88-3 Toluene (December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

108-88-3 Toluene
 109-66-0 n-Pentane
 1330-20-7 Xylene
 64-17-5 Ethyl alcohol
 110-54-3 n-Hexane
 108-87-2 Methyl Cyclohexane
 25551-13-7 Trimethyl benzene
 71-43-2 Benzene
 98-82-8 Cumene
 100-41-4 Ethyl Benzene
 110-82-7 Cyclohexane
 91-20-3 Naphthalene
 96-37-7 Methylcyclopentane
 95-13-6 Indene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

108-88-3 Toluene
 109-66-0 n-Pentane
 1330-20-7 Xylene
 64-17-5 Ethyl alcohol
 110-54-3 n-Hexane
 108-87-2 Methyl Cyclohexane
 25551-13-7 Trimethyl benzene
 71-43-2 Benzene
 98-82-8 Cumene
 100-41-4 Ethyl Benzene
 110-82-7 Cyclohexane
 91-20-3 Naphthalene
 96-37-7 Methylcyclopentane
 95-13-6 Indene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

86290-81-5 Gasoline
 108-88-3 Toluene
 109-66-0 n-Pentane



MATERIAL SAFETY DATA SHEET

MSDS No.: BE95
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 10/25/2011

COKER NAPHTHA

1330-20-7	Xylene
64-17-5	Ethyl alcohol
110-54-3	n-Hexane
108-87-2	Methyl Cyclohexane
25551-13-7	Trimethyl benzene
71-43-2	Benzene
98-82-8	Cumene
100-41-4	Ethyl Benzene
110-82-7	Cyclohexane
91-20-3	Naphthalene
96-37-7	Methylcyclopentane
95-13-6	Indene

Labeling

Other

No additional information available.

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. September 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet

HoustonRefining

A Lyondell Company

AP0888
HFR# 230

Heavy Reformate

Material Safety Data Sheet

Company

Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

MSDS No. AP0888
Revision Date 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent, colorless to slightly yellow. **Odor** Moderate, sweet and pleasant, aromatic hydrocarbon.

DANGER!

Highly flammable liquid; vapor may cause flash fire.

Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.

Liquid contact may cause mild to moderate eye and/or moderate to severe skin irritation and inflammation.

May be harmful if inhaled or absorbed through the skin.

Overexposures may cause central nervous system (CNS) depression and/or other target organ effects.

May be harmful or fatal if ingested.

Aspiration into the lungs can cause pulmonary edema and chemical pneumonia.

Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats).

Potential cancer hazard.

Contains Ethylbenzene and Naphthalene.

May cause blood disorders and kidney and/or liver damage.

Mutagenic hazard; may cause genetic damage.

May adversely affect reproduction or reproductive development.

Spills may create a slipping hazard.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name Heavy Reformate

Product Number 1007210072

CAS Number 64741-68-0

Product Family C7-C12 Petroleum Hydrocarbons

Synonyms Heavy Reformate; Heavy Reformate Naphtha; Reformed Heavy Gasoline; Heavy Platformate; Topped Reformate;
Reformer Naphtha Splitter Tower Bottoms; 733 Rerun Tower Bottoms; ARU Feedstock;
High-Octane Gasoline Blending Component; R-478; ARCO® PX-2 Solvent (former name);
Upper Cylinder & Valve Lubricant; Heavy Catalytic Reformed Naphtha (Petroleum); HCRN.

Business Contact

Product Safety 800-700-0946

24 Hour Emergency Contact

CHEMTREC 800-424-9300

CANUTEC-Canada 613-996-6666

LYONDELL 800-245-4532

Heavy Reformate

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Heavy Catalytic Reformed Naphtha (Petroleum)	64741-68-0	100
2) Heptanes	Mixture	2-6
3) Methylcyclohexane	108-87-2	1-5
4) Toluene	108-88-3	5-15
5) Octanes	Mixture	6-20
6) Xylenes (Mixed Isomers)	1330-20-7	10-25
7) Ethylbenzene	100-41-4	2-7.5
8) Nonanes	Mixture	5-15
9) n-Propylbenzene	103-65-1	1-3
10) Trimethylbenzenes	25551-13-7	10-15
11) 1,2,4-Trimethylbenzene (Pseudocumene)	95-63-6	5-8
12) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	5-10
13) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	1-10
14) Naphthalene	91-20-3	0.1-0.9
15) C10-C12 Alkylbenzenes	70693-06-0	1-10

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this material can cause minimal to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials and components suggest that this material can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline/naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this product may be harmful or fatal.

Toluene may cause a weak cardiac sensitization to epinephrine (adrenalin)-like drugs. Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may

Heavy Reformate

reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational **toluene and xylene** exposures have caused auditory nerve degeneration.

At high exposure concentrations, **ethylbenzene** has been associated with multiple organ tumors in laboratory animals.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylene isomers and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. And, the **C9 aromatic hydrocarbons (cumene, n-propylbenzene, trimethylbenzenes, indene, and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period.

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic. (See Section 11.)

Conditions Aggravated by Exposure Personnel with pre-existing central nervous system (CNS) disease, psychological conditions, skin disorders, impaired hearing, cardiovascular, liver, or kidney function, blood disorders, or chronic respiratory diseases should avoid exposure.

Target Organs The substance is toxic to lungs, central nervous system, especially the auditory nerves, brain, blood, kidneys, liver, heart, thymus, mucous membranes, skin, eyes, and possibly the reproductive system.

Carcinogenic Potential This material contains ethylbenzene and naphthalene at concentrations above 0.1%. **Ethylbenzene and naphthalene** are considered possibly carcinogenic to humans by IARC and "A3 Animal Carcinogens" by ACGIH. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
- Skin Contact** Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
- Ingestion** Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

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Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IB Flammable Liquid. Highly flammable!		
Flash Point Method	CLOSED CUP: -6° to -4°C (21° to 25°F) (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 0.9%	Upper Flammable Limit	AP 7.6%
Autoignition Temperature	AP 232°C (450°F) [ASTM E-659]		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	<p>Flammable Liquid! This material releases vapors at or approaching its flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard's potential, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding. (See American Petroleum Institute Publication 2003).</p>		
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>		
Protection of Fire Fighters	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify authorities if liquid(s) enter sewers or waterways.</p>		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Heavy Reformate

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store other toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Heavy Reformate

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



- Eye Protection** Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.
- Hand Protection** Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, Silver Shield®, PVC/NBR, or fluoroelastomers such as Viton® or Teflon®). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
- Body Protection** Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
- Respiratory Protection** For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).
- General Comments** Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
2) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
3) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
4) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) TWA: 300 (ppm) from ACGIH (TLV)
5) Octane, all isomers	TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
6) Xylenes (Mixed Isomers)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 100 (ppm) from OSHA (PEL)
7) Ethylbenzene ("A3" Animal Carcinogen)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [Proposed] TWA: 100 (ppm) from OSHA (PEL)
8) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) TWA: 200 (ppm) from OSHA (PEL) [Proposed]
9) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) TWA: 25 (ppm) from OSHA (PEL) [Proposed]
10) Naphthalene ("A3" Animal Carcinogen [Proposed])	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed] TWA: 10 (ppm) from OSHA (PEL)

Heavy Reformate

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, colorless to slightly yellow.	Odor	Moderate, sweet and pleasant, aromatic hydrocarbon.
Specific Gravity	0.83 to 0.85 (Water = 1)	pH	Not applicable.	Vapor Density	3.5 to 4.0 (Air = 1)
Boiling Point/Range	85° to 235°C (185° to 455°F) [ASTM D-2887]			Melting/Freezing Point	< -70°C (< -95°F) [ASTM D-97]
Vapor Pressure	2 to 5 mm Hg at 20°C (68°F) or 1.0 to 2.0 Reid-psia at 100°F (37.8°C).			Viscosity (cSt @ 40°C)	1 to 3
Solubility in Water	Soluble in methanol and diethyl ether. Slightly soluble in cold water (< 0.05%).			Volatile Characteristics	Volatile Organic Compounds (VOCs) Content = 100%; 870 to 880 gm/L.

Additional Properties Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 12 to 56 Wt.% [ASTM D-1319];
C7-C12 Aromatic Hydrocarbon Content = 44 to 88 Wt.% [ASTM D-1319];
Average Density at 60°F = 6.994 lbs./gallon [ASTM D-2161];
Dry Point Temperature = AP 437°F (225°C) [ASTM D-86];
Octane Rating = AP 92 [ASTM D-2885];
Sulfur Content = AP 0.01 Wt.% [ASTM D-2622 or D-1266];
Evaporation Rate = 0.2 to 1.7 when n-Butyl acetate = 1.0;
Heat Value = 18,000 to 18,500 Btu.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalies, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Heavy Catalytic Reformate Naphtha (Petroleum): ORAL (LD50): Acute: 4,820 mg/kg [Rat males] - Somnolence, diarrhea, and hypermotility. ORAL (LD50): Acute: 5,040 mg/kg [Rat females] - Somnolence, diarrhea, and hypermotility. GAS (LC50): Acute: > 5,540 mg/L for 4 hours [Rat screen level] - No deaths; somnolence. DERMAL (LD50): Acute: > 2,000 mg/kg (Rabbit screen level). DRAIZE EYE: Acute: Mild to moderate eye irritant. [Rabbit]. DRAIZE DERMAL: Acute: Moderate to severe skin irritant. [Rabbit]. DERMAL (LD50): Acute: > 6,000 mg/kg [Rabbit screen level]. BUELER DERMAL: Acute: Non-sensitizing [Guinea Pig]. 28-Day DERMAL: Sub-Chronic: Moderate skin irritant at 200 mg/kg and severe skin irritant at 1,000 and 2,000 mg/kg [Rabbit]. MUTAGENICITY: Negative or equivocal responses for the modified Ames [Salmonella typhimurium], in vitro Lymphoma [Mouse] with and without S1 activation, and in vivo Bone Marrow Cytogenetics [Rat] assays. n-Heptane: GAS (LC50): Acute: 103,000 mg/m ³ for 4 hours [Rat] - Convulsions. DERMAL (LD50): Acute: > 2,000 mg/kg [Rabbit].
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Heavy Reformate

INTRAVENOUS (LD50): Acute: 222 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 150 mg/kg [Mouse].

Methylcyclohexane:

ORAL (LD50): Acute: 2,250 mg/kg [Mouse].
 GAS (LC50): Acute: 41,500 mg/m³ for 2 hours [Mouse] - Hypermotility and diarrhea.
 GAS (LC50): Acute: 15,227 ppm for 1 hour [Rabbit] - General anesthetic, convulsions,
 and changes in the salivary
 glands.

Toluene:

ORAL (LD50): Acute: 636 mg/kg [Rat].
 ORAL (LD50): Acute: 4,000 mg/kg [Cat].
 GAS (LC50): Acute: 49,000 mg/m³ for 4 hours [Rat].
 GAS (LC50): Acute: 5,320 ppm for 8 hours [Mouse].
 GAS (LC50): Acute: 400 ppm for 24 hours [Mouse].
 DERMAL (LD50): Acute: 14,100 uL/kg or 12,125 mg/kg [Rabbit].
 INTRAVENOUS (LD50): Acute: 1,960 mg/kg [Rat].
 INTRAVENOUS (LD50): Acute: 2,000 mg/kg [Mouse].
 SUBCUTANEOUS (LD50): Acute: 2,250 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 59 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 500 mg/kg [Guinea Pig].
 INTRAPERITONEAL (LD50): Acute: 1,332 mg/kg [Rat].

n-Octane:

GAS (LC50): Acute: 118,000 mg/m³ for 4 hours [Rat].

Xylenes:

ORAL (LD50): Acute: 4,300 mg/kg [Rat].
 GAS (LC50): Acute: 4,550 ppm for 4 hours [Rat].
 DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit].
 SUBCUTANEOUS (LD50): Acute: 1,700 mg/kg [Rat].
 INTRAPERITONEAL (LD50): Acute: 2,459 mg/kg [Rat].
 INTRAPERITONEAL (LD50): Acute: 1,548 mg/kg [Mouse].

Ethylbenzene:

ORAL (LD50): Acute: 3,500 mg/kg [Rat].
 DERMAL (LD50): Acute: 17,800 uL/kg [Rabbit].
 INTRAPERITONEAL (LD50): Acute: 2,624 mg/kg [Rat].

n-Nonane:

GAS (LC50): Acute: 3,200 ppm for 4 hours [Rat].
 INTRAVENOUS (LD50): Acute: 218 mg/kg [Mouse].
 INTRAPERITONEAL (LD₅₀): Acute: 150 mg/kg [Mouse].

n-Propylbenzene:

ORAL (LD50): Acute: 6,040 mg/kg [Rat].
 GAS (LC50): Acute: 65,000 ppm for 2 hours [Rat].

Trimethylbenzenes:

ORAL (LD50): Acute: 8,970 mg/kg [Rat].

1,2,4-Trimethylbenzene:

ORAL (LD50): Acute: 5,000 mg/kg [Rat].
 GAS (LC50): Acute: 18,000 mg/m³ for 4 hours [Rat].

Ethylmethylbenzenes (Ethyltoluenes):

GAS (LC50): Acute: 50,000 mg/m³ for 2 hours [Cat].
 GAS (LC50): Acute: 54,000 mg/m³ for 4 hours [Mouse].

n-Decane:

GAS (LC50): Acute: 72,300 mg/m³ for 2 hours [Mouse].

Naphthalene:

ORAL (LD50): Acute: 490 mg/kg [Rat].
 ORAL (LD50): Acute: 533 mg/kg [Mouse].
 ORAL (LD50): Acute: 1,200 mg/kg [Guinea Pig].

Subchronic (28-day) dermal studies with **heavy catalytic reformed naphtha (petroleum)** using rabbits showed animal weight loss or reduced weight gain, renal tubule changes and acute tubular necrosis, plus moderate to severe skin irritation without sensitization. Heavy catalytic reformed naphtha also produced negative or equivocal responses mutagenic responses in series of various assays. The significance of these animal mutagenicity study results to human health is unclear.

Long-term mouse skin painting studies sponsored by the American Petroleum Institute (API) showed **heavy catalytic reformed naphtha (petroleum)** did not produce any increased incidence of benign skin

Heavy Reformate

tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). Average latency period was 80 weeks. All animals survived throughout the study. A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of similar and heavier **petroleum distillates**.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by inhalation and dermal exposure and repeated direct skin application can produce defatting dermatitis. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (< 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for one hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for six hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD₅₀ somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for six hours per day, five days per week, for three weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation

Heavy Reformate

studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

NTP completed a 2-year inhalation bioassay of **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Prolonged and/or repeated overexposure to **cumene (isopropylbenzene)** via inhalation or skin absorption can cause liver and/or kidney damage.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. Its TC_{L_0} for humans 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation studies with rats, four of ten animals died after exposures of 2,400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. **Mesitylene (1,3,5-Trimethylbenzene)** inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Ethylmethylbenzenes are primary skin irritants and overexposures might cause liver and/or kidney

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damage or increase blood cholinesterase levels. Inhalation of these and other **C9 aromatic hydrocarbons** by pregnant mice and rats during gestational days 6 through 15 resulted in decreased fetal and newborn weights.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction of red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in eight of 21 workers exposed to elevated levels of naphthalene vapors for five years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Based upon animal studies, naphthalene may cause fetal toxicity or damage and decreased spleen weights in pregnant female mice.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay of **naphthalene**. The study was conducted in male and female F344/N rats at exposure concentrations of 0, 10, 30, and 60 ppm. No significant effects were observed at the 10 ppm levels. However, compared to chamber controls, there was a dose-related increase in tumors generated at the 30 and 60 ppm levels in both males and females. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas, and non-neoplastic lesions of the nose were observed when compared to chamber controls. Additionally, in cytogenic tests with Chinese hamster ovary cells, naphthalene induced significant increases in sister chromatid exchanges with and without metabolic activation (S9) and chromosomal aberrations with S9. The relevance of these findings to human health is unclear; however, based upon this data, the IARC has determined naphthalene to be possibly carcinogenic to humans (Class 2B).

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Volatile **aromatic hydrocarbon components (toluene, xylenes, ethylbenzene, cumene, indene, trimethylbenzenes, and naphthalene)** may be released and possibly contribute to the creation of atmospheric smog. **Toluene** has a half-life of from 3 hours to slightly over 1 day when hydroxyl radicals are present.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 60 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), Guppy (*Lebistes reticulatus*) and juvenile American Shad (*Squalius cephalus*) in fresh water. Also, 24-hour and 96-hour LC50s for **toluene** produced results from 25 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), toluene showed 24-hour TLms of from 100 ppm to 200 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

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SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated with this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (U220) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Xylenes, Trimethylbenzenes)		
Hazard Class	DOT Class: 3 (Flammable liquid).	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this material which may require DOT HAZMAT bill-of-lading display are Xylenes and Toluene .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	All impacted components were delisted as DOT "Marine Pollutants" per 66 FR 120 (page 33413) dated 6/21/2001.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) Inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

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Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.

SARA 313

This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313:

Toluene [CAS No. 108-88-3] concentration: 5 to 15%

Xylenes [CAS No. 1330-20-7] concentration: 10 to 25%

Ethylbenzene [CAS No. 100-41-4] concentration: 2 to 7.5%

Cumene (Isopropylbenzene) [CAS No. 92-82-8] concentration: 0.1 to 0.9%

1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 95-63-6] concentration: 5 to 8%

Naphthalene [CAS No. 91-20-3] concentration: 0.1 to 0.9%.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are:

Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 5 to 15%

2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 0.5 to 5%

Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 10 to 25%

Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 2 to 7.5%

Cumene [CAS No. 92-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0.1 to 0.9%

Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 0.9%.

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: **Toluene [CAS No. 108-88-3] and Naphthalene [CAS No. 91-20-3].**

New Jersey Right-to-Know Label

For New Jersey labeling, refer to the components listed in Section 2.

Additional Regulatory Remarks

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Toluene (CAS No. 108-88-3), Xylenes (mixed) (CAS No. 1330-20-7), Ethylbenzene (CAS No. 100-41-4), and Cumene (Isopropylbenzene) (CAS No. 98-82-8).**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION Logo and Manufacturer name change.
Version Number 13.1
Revision Date 11/01/06

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
 ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
 IARC: International Agency for Research on Cancer NTP: National Toxicology Program
 NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
 NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System

HoustonRefining

A Lyondell Company

Heavy Reformate

NFPA: National Fire Protection Association

EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

MATERIAL SAFETY DATA SHEET

AP1159

 MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

HFR#1,3,0

1. PRODUCT AND COMPANY IDENTIFICATION
Product name: DEPENTANIZED COKER NAPHTHA

Number: 00000000000014942

Internal ID: AP1159

Chemical characterization: C7-C12 Petroleum Hydrocarbons

CAS-No.: 64741-83-9

Synonyms: Delayed Coker Heavy Gasoline or Naphtha, Untreated or Unrefined Heavy Naphtha or Gasoline, 534 Depentanizer Tower Bottoms, 534 Unit Gasoline Splitter Tower Bottoms, Coker Naphtha Splitter Bottoms, Untreated Heavy Gasoline, 632 HDS Unit Feedstock, Feedstock to the Hydrodesulfurization Unit, Heavy Thermal Cracked Naphtha (Petroleum), HTC/N, 631 HDS Unit Feedstock

Company Address

 Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

 Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

 CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION
Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

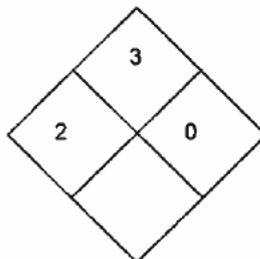
Signal Word

WARNING.

Hazards

Extremely flammable. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. Vapor may cause flash fire or explosion. May be irritating to the skin. May cause central nervous system effects. Aspiration hazard. May cause lung damage. Possible cancer hazard. Mutagenic Substance. May affect the unborn. May effect hearing. Dangerous for the environment.

NFPA®



HMIS®

Health	*	1
Flammability		3
Physical Hazard		0

Physical state

liquid

Color



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Color

colorless to light yellow

Odor

Aromatic or gasoline-like odor.

Odor Threshold

No value available.

Potential health effects

Routes of exposure

Eye. Inhalation. Skin.

Acute effects

Inhalation hazard. May cause drowsiness and dizziness. See component summary.

- *Xylene 1330-20-7*

May be irritating to the eyes, skin, and respiratory system. Aspiration hazard. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Trimethyl benzene 25551-13-7*

CNS depressant. Aspiration hazard.

- *1,2,4-Trimethylbenzene 95-63-6*

May cause eye and skin irritation. Respiratory tract irritant. CNS depressant. Aspiration hazard.

- *n-Hexane 110-54-3*

May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. May be irritating to the skin. High or repeated exposures can damage the peripheral nervous system, causing numbness, tingling, and/or muscle weakness in the hands or feet. The onset of health effects associated with n-hexane may be influenced by exposure to additional chemicals such as methyl isobutyl ketone and methyl ethyl ketone.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *Indene 95-13-6*

May cause drowsiness and dizziness. Aspiration into the lungs may cause chemical pneumonia.

- *Naphthalene 91-20-3*

May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

Skin

May produce skin irritation. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis. May cause irritation to the skin. This irritation can result in redness and swelling of the skin. Repeated contact with the skin may cause it to become dry and cracked. May be absorbed through the skin and produce toxic effects such as CNS depression. May be absorbed through the skin and produce toxic effects such as CNS depression. May cause dermatitis by defatting the skin from prolonged or repeated contact. Short-term contact symptoms include redness, itching, and burning of the skin. May be absorbed through the skin and produce toxic effects such as CNS depression. If the skin is damaged, absorption increases.

Inhalation

Can cause pulmonary edema if aspirated into lungs. May produce symptoms of central nervous system depression



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Inhalation

including headache, dizziness, nausea, euphoria, loss of equilibrium, drowsiness, visual disturbances, fatigue, unconsciousness and respiratory arrest. High concentrations of this substance may cause cardiac arrhythmias that may be fatal. Hydrogen sulfide is a highly toxic gas that can be fatal in certain concentrations. Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression. High concentrations can displace oxygen and cause drowsiness, dizziness, unconsciousness and/or suffocation by asphyxiation.

Eyes

May cause moderate irritation, including burning sensation, tearing, redness or swelling. Effects of eye irritation are reversible. May cause moderate irritation, including burning sensation, tearing, redness or swelling. May cause blurred vision. Effects may become more severe with repeated or prolonged contact.

Ingestion

Aspiration may cause lung damage. Harmful if swallowed. May cause abdominal discomfort, nausea and diarrhea. Aspiration into the lungs during swallowing or vomiting can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section. Readily absorbed upon ingestion and may produce toxic effects similar to those resulting from inhalation exposure. Ingestion followed by vomiting could result in aspiration into the lungs of the more volatile components of this material which in turn could lead to life-threatening chemical pneumonia. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

Chronic effects

Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung tumor) formation and chronic lung dysfunction. Altered mental states, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "petrol sniffers encephalopathy"), delirium, seizures, and sudden death have been common symptoms among gasoline and naphtha abusers. Repeated or prolonged contact with the skin may cause defatting dermatitis. Toluene has a cumulative effect on the nervous system. Irritation of mucous membranes, headaches, dizziness, nausea, loss of appetite, intolerance to alcohol, and auditory nerve degeneration have been reported with chronic toluene exposure. Possible cancer hazard (contains a material which may cause cancer based on animal data). May cause developmental toxicity. May affect the unborn.

- *Xylene 1330-20-7*

May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard.

- *Trimethylbenzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *1,2,4-Trimethylbenzene 95-63-6*

Repeated or prolonged skin contact may defat the skin and produce dermatitis.

- *n-Hexane 110-54-3*

Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Prolonged and repeated exposure to vapors may cause damage to the CNS, lungs and kidneys. Suspect reproductive hazard.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Ethyl Benzene 100-41-4*

May affect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *Indene 95-13-6*

No known chronic health effects.

- *Naphthalene 91-20-3*

Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Potential Cancer Hazard, see section 11.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

Aggravated Medical Condition

Any pre-existing disorders or diseases of the: central nervous system (CNS) skin respiratory system liver kidney

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Naphtha (petroleum) heavy thermal cracked	64741-83-9	265-085-0	100.0
Xylene	1330-20-7	215-535-7	5.0 <= 10.0
Trimethyl benzene	25551-13-7	247-099-9	5.0 <= 10.0
1,2,4-Trimethylbenzene	95-63-6	202-436-9	2.0 <= 5.0
n-Hexane	110-54-3	203-777-6	1.0 <= 3.0
Toluene	108-88-3	203-625-9	1.0 <= 3.0
Hexane isomers			0.5 <= 1.5
Ethyl Benzene	100-41-4	202-849-4	0.5 <= 1.5
Indene	95-13-6	202-393-6	0.5 <= 1.5
Naphthalene	91-20-3	202-049-5	0.5 <= 1.5
Benzene	71-43-2	200-753-7	0.1 <= 0.5

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. Never use low boiling point naphthas for washing contaminated skin. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

Notes to physician

Treat symptomatically. Inhalation may cause CNS depression. Overexposure may produce anesthetic or narcotic effects. Do not induce vomiting. Risk of damage to lungs exceeds poisoning risk. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IA flammable liquid.

Flash point

< 0 °C (32 °F) closed cup

Autoignition temperature

280 - 470 °C (536 - 878 °F)

Lower explosion limit

~ 1.4 vol%

Upper explosion limit

~ 7.6 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemical, CO₂, water spray or regular foam. LARGE FIRES: Use water spray, dry chemical, foam, or carbon dioxide. Do not use solid water stream/may spread fire.

Unsuitable extinguishing media

Do not use solid water stream/may spread fire.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear.

Precautions for fire-fighting

When exposed to ignition source in air, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. Releases flammable vapors below normal ambient temperatures. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Prevent fire extinguishing water from contaminating surface water or the ground water system. When fighting a fire, notify environmental authorities if liquid enters sewers or public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Thermal decomposition may produce carbon



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Precautions for fire-fighting
 monoxide and other toxic vapors.

Hazardous combustion products
 Carbon Monoxide. Carbon dioxide. Oxides of nitrogen.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Release causes immediate fire/explosion hazard. Evacuate all non-essential personnel to an area upwind (at least 1/2 mile in all directions if tanks or tank cars are involved in fire or spill). A vapor suppressing foam may be used to reduce vapors. Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Stop leak if you can do it without risk. Do not touch or walk through spilled material. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material. Contain spill with dike to prevent entry into sewers or waterways. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Use suitable disposal containers.

7. HANDLING AND STORAGE

Handling

Ensure all equipment is electrically grounded before beginning transfer operations. Eliminate every possible source of ignition. Spilled material can make walking hazardous, potentially causing falls and serious injury. Do not breathe vapor. Avoid contact with skin. Do not smoke. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Use good housekeeping practices during use, storage, transfer, and handling. Electrostatic charges may be generated as a result of flow or agitation. A static spark or discharge can ignite accumulated vapors, particularly during dry weather conditions. Bond and ground all equipment before transferring this material from one container to another. Do not fill any portable container in or on a vehicle without proper bonding. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance.

Storage

Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room. All equipment must conform to applicable electrical code. Store and transport in accordance with all applicable laws.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. The type of respiratory protection will depend upon whether the maximum exposure concentration is known.

Consider the maximum period for wear. If exposure can potentially exceed the exposure limit(s), respiratory protection recommended or approved by appropriate local, state or international agency must be used.

Skin

Wear insulated gloves if contact with liquid is possible. Wear chemical resistant gloves such as: Glove material fluoroelastomer; material thickness 0.4 mm; break through time \geq 480 min. Gloves must be replaced after 8 hours of wear. The suitability for a specific workplace should be discussed with the producers of the protective gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. When skin contact is possible,



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Skin

protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Promptly remove and discard contaminated leather goods (gloves, belts, shoes, wallets, etc). Upon clothing contamination, immediately remove soaked clothing and shower. Choose body protection according to the amount and concentration of the dangerous substance at the work place. Fire retardant clothing is appropriate for routine occupational use.

Eyes

Safety glasses Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid.

Remarks

Wash hands before eating, drinking, smoking, or using toilet facilities. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Use good personal hygiene practices.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Xylene	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
Trimethyl benzene	US (OSHA)	TWA	25 ppm	None.
	US (ACGIH)	TWA	25 ppm	None.
n-Hexane	US (ACGIH)	TWA	50 ppm	None.
	US (OSHA)	TWA	500 ppm 1,800 mg/m ³	None.
	NIOSH	IDLH	1,100 ppm	None.
Toluene	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.
Ethyl Benzene	US (ACGIH)	STEL	125 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
	NIOSH	IDLH	800 ppm	None.
Indene	US (ACGIH)	TWA	5 ppm	None.
Naphthalene	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.


MATERIAL SAFETY DATA SHEET

 MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Benzene	US (OSHA)	TWA	10 ppm 50 mg/m ³	None.
	NIOSH	IDLH	250 ppm	None.
	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
	NIOSH	IDLH	500 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid colorless, to, light yellow

Odor: Aromatic or gasoline-like odor.

Odor Threshold: No value available.

pH: Not applicable.

Boiling point/boiling range: 88 - 260 °C (190.4 - 500 °F)

Melting/freezing point: < -20 °C (-4 °F)

Flash point: < 0 °C (32 °F) closed cup

Autoignition temperature: 280 - 470 °C (536 - 878 °F)

Flammability: OSHA/NFPA Class IA flammable liquid.

Lower explosion limit: ~ 1.4 vol%

Upper explosion limit: ~ 7.6 vol%

Explosive properties: No Data Available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Oxidizing properties: No Data Available.

Vapor pressure: 4 - 240 kPa @ 37.8 °C (100.04 °F)

Evaporation rate: No Data Available.

Relative density: 0.62 - 0.88 @ 15 °C (59 °F) (Water = 1)

Relative vapor density: No Data Available.

Viscosity: ~ < 1 mm²/s @ ~ 37.8 °C (100.04 °F)

Water solubility: Slightly soluble in cold water.

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks, open flames and strong oxidizing conditions. Contact with strong acids.

Hazardous decomposition products

No degradation data available.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Inhalation of high vapor concentrations can cause CNS-depression and narcosis. Inhalation of vapors in high concentration may cause shortness of breath (lung edema). Solvents may degrease the skin. Prolonged exposure may produce anesthetic and narcotic effects. (See Component Toxicity Information).

Acute toxicity

<u>LC50 (Inh)</u>	rat	>5.61 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	>5,000 MG/KG	
<u>LD50 (Skin)</u>	rabbit	>2000 MG/KG	

Acute effects

Inhalation

Predicted exposure concentration. Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Inhalation may cause CNS depression. Can cause pulmonary edema if aspirated into lungs.

Ingestion



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Skin irritant. Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Eyes

Non-irritating to the eyes. Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Blood. Liver. Kidneys. Lung. Central nervous system.

Reproductive effects

Stream expected not to be toxic to reproduction based on toxicity information for streams having components in common with this stream.

Developmental Toxicity

Suspected of damaging the unborn child. Stream expected to be toxic to development based on toxicity information for components present in this stream.

Genetic Toxicity

Mutagenic Substance. May cause genetic defects. Stream expected to be mutagenic based on toxicity information for components present in this stream.

Carcinogenicity

May cause cancer. Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream.

COMPONENT INFORMATION

- *Naphtha (petroleum) heavy thermal cracked* 64741-83-9

Other information

See Product Summary

- *Xylene* 1330-20-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	5000 PPM	4 HOURS
	mouse	3907 MG/KG	6 HOURS
	rat	4550 PPM	4 HOURS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

LD50 (Oral) rat 4300 MG/KG
LD50 (Skin) rabbit >1700 MG/KG

Irritation

Skin

Moderate skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

This material is expected to be a mild eye irritant. Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Target Organs

Skin. Eye. central nervous system (CNS)

Repeated dose toxicity

Repeated inhalation exposures of rats to xylenes cause liver effects at 920 ppm (4.0 mg/L) and ototoxicity at \geq 800 ppm (3.48 mg/L). Repeated oral exposures to xylenes produce reductions in body weight in male rats at 500 mg/kg bwt/day; liver effects and hyaline droplet formation in male rats at \geq 150 mg/kg bwt/day; kidney effects in male and female rats at \geq 750 mg/kg bwt/day; and a reduction in bodyweight gain in male mice at \geq 250 mg/kg bwt/day. Repeated inhalation exposures of gerbils to \geq 160 ppm (0.70 mg/L) xylenes cause apparently irreversible CNS effects.

Reproductive effects

A reproductive toxicity study, two dominant lethal studies, and evaluation of reproductive organs in repeated dose studies indicate that xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at non-anesthetic doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

Results from animal studies demonstrate that xylenes may cause reduced fetal weight and delayed ossification, but not malformations, at inhalation dose levels causing no or only slight maternal toxicity (\geq 115 ppm or 0.5 mg/L). Slight neurobehavioral effects were noted in offspring of rats exposed to 500 ppm (2.2 mg/L) in the absence of maternal toxicity.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Trimethyl benzene* 25551-13-7

Acute toxicity

LD50 (Oral) rat 8970 MG/KG

Irritation

Skin

Skin irritant.

- *1,2,4-Trimethylbenzene* 95-63-6

Acute toxicity

LC50 (Inhi) rat 18 G/M3 4 HOURS

Target Organs

Eye. Skin. Respiratory system. Central nervous system. Blood.

Repeated dose toxicity

Repeated inhalation exposures to 1,2,4-trimethyl-benzene causes changes in hematological parameters in male rats at 250 ppm (1.23 mg/L); and pulmonary lesions in male and female rats at \geq 100 ppm (1.23 mg/L).

Developmental Toxicity

Results from a repeated dose inhalation test with trimethylbenzene showed fetotoxicity in rats (decreased pup bodyweight) at \geq 600 ppm (2.95 mg/L) in the presence of maternal toxicity (reduced body weight gain).

Genetic Toxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Target Organs

Trimethylbenzene was positive in a bacterial gene mutation assay and produced sister chromatid exchanges in mouse bone marrow (at ≥ 730 mg/kg bwt), but did not induce micronuclei in the same cells.

- *n*-Hexane 110-54-3

Acute toxicity

<u>LC50 (Inh)</u>	rat	48,000 PPM	4 HOURS
<u>LD50 (Oral)</u>	rat	28,710 MG/KG	
<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	

Irritation

Eyes

Eye irritant.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Peripheral nervous system Testes.

Repeated dose toxicity

Rabbits exposed by inhalation to 3,000 ppm 8 hours/day for 8 days showed changes in the lungs, emphysema, necrosis of the bronchial epithelium, and atelectasis. Rats continuously exposed to 400 ppm developed axonopathy, although intermittent exposure to 10,000 ppm 6 hours/day, 5 days/week for 13 weeks caused only mild paranodal axonal swelling. The offspring of rats and mice exposed orally or by inhalation to *n*-hexane during gestation showed depressed weight gain after birth. This agent also affects male and female reproductive capacity.

Reproductive effects

Exposure to *n*-hexane may damage the developing fetus.

Developmental Toxicity

Causes productive and embryotoxic effects and is cytotoxic in mammalian and human test systems.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

Exposure of humans to 5,000 ppm *n*-hexane for 10 minutes causes marked vertigo; exposure to 1,500 ppm results in headache and slight nausea. In industrial settings, exposure to levels exceeding 1,000 ppm have been reported to cause mild symptoms of narcosis. Eye and upper respiratory tract irritation has been reported to occur in humans exposed to 880 ppm *n*-hexane for 15 minutes. Dermal contact with *n*-hexane results in immediate irritation characterized by erythema and hyperemia; exposed subjects developed blisters 5 hours following dermal exposure to *n*-hexane. The neuropathic toxicity of *n*-hexane in humans is well documented; cases of polyneuropathy have typically occurred in humans chronically exposed to levels of *n*-hexane ranging from 400 to 600 ppm, with occasional exposures up to 2,500 ppm. Distal symmetrical motor weakness is common in most cases; however, in severely affected individuals, motor weakness may extend to the pelvic and high musculature. Nerve biopsies in affected individuals show swelling of the nerve and thinning of the myelin sheath. Functional neurological disturbances usually progress for a few months after termination of exposure. Although recovery is expected to occur within a year, clinical polyneuropathy has been reported in some cases to remain after 2 years. Blurred vision, restricted visual field, and optic nerve atrophy has been reported to occur in association with *n*-hexane-induced polyneuropathy.

- Toluene 108-88-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *Hexane Isomers*

Other information

No data available.

- *Ethyl Benzene 100-41-4*

Acute toxicity

LC50 (vapor) rat 4000 PPM



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

LD50 (Oral) rat 3500 - 4700 MG/KG BWT

LD50 (Skin) rabbit > 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of ≥ 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *Indene 95-13-6*

Acute toxicity

LC50 (Inhl) rat 14 GM/M3

Carcinogenicity

Specific data not available.

- *Naphthalene 91-20-3*

Acute toxicity

LC50 (Inhl) rat >340 MG/M3 4 HOUR

LD50 (Oral) rat 490 MG/KG
 mouse 533 MG/KG
 guinea pig 1200 MG/KG

Irritation

Skin

May be irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Repeated inhalation or ingestion of naphthalene causes methemoglobinemia*

Developmental Toxicity

Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bwt/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bwt/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice).

Genetic Toxicity

Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bwt orally or 250 mg/kg bwt by intraperitoneal injection.

Carcinogenicity

The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).

- *Benzene 71-43-2*

Acute toxicity

rat 13,700 PPM 4 HOURS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

rabbit > 8260 MG/KG BWT

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered bodyweight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Toxic to aquatic life with long lasting effects.

Acute Fish toxicity

LL50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 10 mg/l

LL50 / 96 HOURS Pimephales promelas (fathead minnow) 8.2 mg/l

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS Daphnia magna (Water flea) 4.5 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Toxicity to aquatic plants

EL50 / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 3.1 mg/l

NOELR / 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 0.5 mg/l

Toxicity to microorganisms

EC50 / 40 HOURS *Tetrahymena pyriformis* (ciliated protozoa) 15.41 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOELR / 14 d fish. 2.6 mg/l

Summary: QSAR (Quantitative structure-activity relationship) based calculation predicts low chronic toxicity.

Chronic toxicity to aquatic invertebrates

NOELR / 21 d *Daphnia magna* (Water flea) 2.6 mg/l

Environmental fate and pathways

If released to water it will float. This material is likely to evaporate from soil and water.

COMPONENT INFORMATION

- *Naphtha (petroleum) heavy thermal cracked* 64741-83-9

Ecotoxicity

Other adverse effects

See Product Summary

Environmental fate and pathways

- *Xylene* 1330-20-7

Ecotoxicity

This material is classified as harmful to fish.

Acute Fish toxicity

LC50 / 96 HOUR rainbow trout. 13.5 mg/l

LC50 / 24 HOUR goldfish 13 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Expected to have moderate mobility in soils. Volatilization from moist soil surfaces is expected. Volatilization from dry soil surfaces is expected.

Persistence and degradability

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *1,2,4-Trimethylbenzene* 95-63-6

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS fathead minnow 7.72 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 6.14 mg/l

Environmental fate and pathways

No Data Available.

- *n-Hexane* 110-54-3

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 4.14 mg/l

LC50 / 96 HOUR Pimephales promelas 2.5 mg/l

LC50 / 96 HOURS Lepomis macrochirus 4.12 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 3.87 mg/l

Environmental fate and pathways

Photolysis, hydrolysis or bioconcentration of n-hexane are not expected to be an important environmental fate processes. Biodegradation of n-hexane may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A Koc range of 1250 to 4100 indicates a low to slight mobility class in soil for n-hexane. In aquatic systems n-hexane may partition from the water column to organic matter contained in sediments and suspended materials. Rapid volatilization from environmental waters is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 55 mg/l

LC50 / 96 HOUR *Carassius auratus* 22.8 mg/l

LC50 / 96 HOUR *Pimephales promelas* 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY *Oncorhynchus* sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY *Daphnia magna*. 1.0 mg/l

NOEC / 7 DAY *Ceriodaphnia dubia* 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Hexane Isomers*

Ecotoxicity

Environmental fate and pathways

No data available.

- *Ethyl Benzene* 100-41-4

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 / 96 HOUR *Menidia menidia* 5.1 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna* 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Indene* 95-13-6

Ecotoxicity

No data available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

Environmental fate and pathways

No data available.

- *Naphthalene* 91-20-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS rainbow trout 26 mg/l

Summary: Very toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna 21.9 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: Naphthalene has a moderate tendency to bioaccumulate although fish and microorganisms readily metabolize it.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna 10 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Pseudokirchneriella subcapitata (green algae) 32 mg/l

Toxicity to microorganisms

IC50 / 24 HOURS Nitrosomonas sp. 13 mg/l

Chronic toxicity to fish

LOEC / 32 DAY Pimephales promelas 1.6 mg/l

Chronic toxicity to aquatic invertebrates

NOEC / 7 DAY Ceriodaphnia dubia 3 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

13. DISPOSAL CONSIDERATIONS

It is the responsibility for the waste generator to characterize waste streams relative to the pertinent regulatory provisions to ensure that applicable requirements are reviewed and met. Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations. Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. The materials resulting from clean-up operations may be hazardous wastes and therefore, subject to specific regulations. Contaminated product, soil, water, and empty containers may be hazardous wastes due to possible presence of flammable gases. Assure emissions comply with applicable regulations. Proper grounding procedures to avoid static electricity should be followed.

14. TRANSPORT INFORMATION

Proper shipping name Petroleum distillates, n.o.s. (XYLENE, TRIMETHYLBENZENES)

Reportable quantity XYLENE
 TOLUENE

ID No. UN1268
Hazard class 3
Packing group II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Korea	ECL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Xylene		100 lbs
n-Hexane		5000 lbs
Toluene		1000 lbs
Ethyl Benzene		1000 lbs
Naphthalene		100 lbs
Benzene		10 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Fire Hazard.
 Delayed (Chronic) Health Hazard.
 Immediate (Acute) Health Hazard.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

SARA 311/312

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

<u>Component</u>	<u>Reporting Threshold</u>
Xylene	1.0%
1,2,4-Trimethylbenzene	1.0%
n-Hexane	1.0%
Toluene	1.0%
Ethyl Benzene	0.1%
Naphthalene	0.1%
Benzene	0.1%

State Reporting

Known to the State of California to cause cancer.

100-41-4	Ethyl Benzene	(December 11, 2009)
91-20-3	Naphthalene	
71-43-2	Benzene	

Known to the State of California to cause birth defects.

108-88-3	Toluene	(December 11, 2009)
71-43-2	Benzene	

Known to the State of California to cause reproductive toxicity in males.

71-43-2	Benzene	(December 11, 2009)
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Known to the State of California to cause reproductive toxicity in females.

108-88-3	Toluene	(December 11, 2009)
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This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

1330-20-7	Xylene
25551-13-7	Trimethyl benzene
95-63-6	1,2,4-Trimethylbenzene
110-54-3	n-Hexane
108-88-3	Toluene
100-41-4	Ethyl Benzene
95-13-6	Indene
91-20-3	Naphthalene
71-43-2	Benzene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

1330-20-7	Xylene
25551-13-7	Trimethyl benzene
95-63-6	1,2,4-Trimethylbenzene
110-54-3	n-Hexane
108-88-3	Toluene
100-41-4	Ethyl Benzene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE99
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

DEPENTANIZED COKER NAPHTHA

95-13-6 Indene
 91-20-3 Naphthalene
 71-43-2 Benzene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

1330-20-7 Xylene
 25551-13-7 Trimethyl benzene
 95-63-6 1,2,4-Trimethylbenzene
 110-54-3 n-Hexane
 108-88-3 Toluene
 100-41-4 Ethyl Benzene
 95-13-6 Indene
 91-20-3 Naphthalene
 71-43-2 Benzene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:
 Conversion to SAP template. June 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

AP1595
 HFR# 371

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: DSO

Number: 000000000000014949

Chemical characterization: Dithioalkanes and C5-C7 Hydrocarbon

CAS-No.: 68955-96-4

Chemical Name: Dialkyl Disulfides From LPG/Naphtha Sweetening

Synonyms: Merox Disulfide Oil, Merox DS, MDSO, Merox Presulfiding Disulfide Oil, Disulfide Oil 253, LI-253, Cracking Inhibitor 150, CI-150 (former names), Mixed Dialkyl Disulfides From Sweetening Process

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

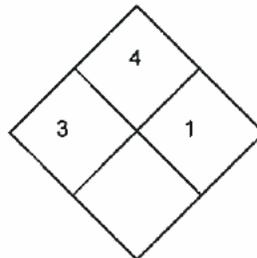
Signal Word

DANGER.

Hazards

Extremely flammable liquid. High concentrations can displace oxygen and cause drowsiness, dizziness, unconsciousness and/or suffocation by asphyxiation. Possible reproductive toxin. Possible cancer hazard. This material also contains components that may cause hearing loss and may be a developmental toxin.

NFPA®



HMIS®

Health	*	3
Flammability		4
Physical Hazard		1

Physical state

liquid

Color

yellow

Odor



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Odor
 Pungent.

Odor Threshold
 No value available.

Potential health effects

Routes of exposure
 Inhalation. Ingestion. Skin.

- *Dimethyl Disulfide* 624-92-0
 Respiratory tract irritant. CNS depressant.

- *Benzene* 71-43-2

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Toluene* 108-88-3

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *n-Hexane* 110-54-3

May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. May be irritating to the skin. High or repeated exposures can damage the peripheral nervous system, causing numbness, tingling, and/or muscle weakness in the hands or feet. The onset of health effects associated with n-hexane may be influenced by exposure to additional chemicals such as methyl isobutyl ketone and methyl ethyl ketone.

- *Methyl Mercaptan* 74-93-1

CNS depressant. May be irritating to the eyes.

- *Ethyl Mercaptan* 75-08-1

Harmful if swallowed.

Skin

May be mildly irritating to the skin. May be absorbed through the skin and produce toxic effects such as CNS depression. Repeated or prolonged contact may cause skin irritation.

Inhalation

Vapors or mists from this material can irritate the nose, throat and lungs, and cause signs and symptoms of central nervous system (CNS) depression, depending on the concentration and duration of exposure.

Ingestion

Irritates mucous membranes of the mouth, throat, and esophagus and is readily absorbed by the stomach and intestinal tract. CNS symptoms include nausea, vomiting, pallor, dizziness, staggering gait, drowsiness, shallow rapid pulse, loss of consciousness, and delirium prior to the onset of convulsions, coma, and death. Ingestion and/or vomiting of this material may result in aspiration into the lungs. Even a small amount of this liquid entering the lungs can produce potentially fatal effects (pulmonary edema and pneumonitis). Ingestion will result in burning of the mouth, throat and any part of the gastrointestinal system with which the material comes in contact. Nausea and vomiting may occur.

- *Dimethyl Disulfide* 624-92-0

Component caused a decrease in body weight gain in lab animals.

- *Benzene* 71-43-2

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Toluene* 108-88-3

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *n-Hexane* 110-54-3

DSO

Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Prolonged and repeated exposure to vapors may cause damage to the CNS, lungs and kidneys. Suspect reproductive hazard.

- *Methyl Mercaptan 74-93-1*

Component caused a decrease in body weight gain in lab animals.

- *Ethyl Mercaptan 75-08-1*

May cause nausea. Repeated or prolonged exposure may irritate the mucous membranes.

Aggravated Medical Condition

Persons with pre-existing skin disorders, peripheral or central nervous system (CNS) disease, psychological conditions, cardiac conditions, impaired pulmonary, cardiovascular, or liver/kidney function, or chronic respiratory diseases should avoid exposure. Any pre-existing disorders or diseases of the: skin and/or blood

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Disulfides, dialkyl and di-Ph, naphtha sweetening	68955-96-4		99.0 <= 100.0
Dimethyl Disulfide	624-92-0	210-871-0	10.0 <= 25.0
Light sweetened naphtha (petroleum)	64741-87-3	265-089-2	<= 1.0
Benzene	71-43-2	200-753-7	<= 0.1
Toluene	108-88-3	203-625-9	<= 1.0
n-Hexane	110-54-3	203-777-6	<= 1.0
Methyl Mercaptan	74-93-1	200-822-1	<= 0.5
Ethyl Mercaptan	75-08-1	200-837-3	<= 0.5

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Immediately remove excess chemical and contaminated clothing; thoroughly wash contaminated skin with mild soap and water. If irritation persists after washing, seek medical attention. Thoroughly clean contaminated clothing before reuse; discard contaminated leather goods (gloves, shoes, belts, wallets, etc.).

Inhalation

Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Eyes

Immediately flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower lids. If pain or irritation persists, promptly obtain medical attention.

Ingestion

Rinse mouth with lukewarm water. DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Obtain medical attention.

Notes to physician

Do not induce vomiting. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Gastric lavage may also be indicated. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of pulmonary/upper airway edema. Provide 100% humidified supplemental oxygen with assisted ventilation if needed.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

Extremely flammable.

Flash point

~ 17.78 °C (64 °F)

Autoignition temperature

~ 219.44 °C (426.99 °F) (ASTME659).

Lower explosion limit

~ 1 vol% (% vol in air).

Upper explosion limit

~ 7.6 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Dry chemical, CO₂ (carbon dioxide) foam water fog Inert gas - Halon/N₂. LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams

Unsuitable extinguishing media

Do not use solid water stream/may spread fire.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear a NIOSH approved positive pressure self-contained breathing apparatus (SCBA). Fight fire from a safe distance/protected location. Use water spray/fog to disperse vapors below flammable limit.

Precautions for fire-fighting

Vapor is heavier than air, may travel long distance along the ground before igniting and flash back to vapor source. Evacuate area and fight from a maximum distance or use unmanned hose holders or monitor nozzles. Heat may generate flammable or explosive vapors; disperse with water spray or cover pooling liquid with foam. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks.

6. ACCIDENTAL RELEASE MEASURES



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Spills and leaks

Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material. Evacuate/limit access. Evacuate all non-essential personnel to an area upwind (at least 1/2 mile in all directions if tanks or tank cars are involved in fire or spill). Water spray may reduce vapor, but may not prevent ignition in closed spaces.

7. HANDLING AND STORAGE

Handling

Store in tightly closed containers. Keep away from all sources of ignition. Leaks onto ground may cause slippery walking surface, increasing risk of falls/injury. Liquid material is slippery-remove small leaks/spills from walking surface with solid absorbent. Use only with adequate ventilation/personal protection. Avoid breathing vapors, mist or gas. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. All electrical equipment should be grounded and conform to applicable electric codes and regulatory requirements. Handle empty containers with care - residue may be flammable/poisonous.

Storage

Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. Electrical equipment should be grounded and conform to applicable electrical code. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

If exposure exceeds the standard limits, respiratory protection equipment which meets 29 U.S. Code of Federal Regulations (CFR) 1910.134 and is U.S. National Institute for Occupational Safety and Health (NIOSH) approved must be worn.

Skin

Wear chemical resistant gloves such as: PVC Nitrile, Neoprene, or Butyl rubber. Avoid contact with skin. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Use PPE that is chemical resistant to the product and prevents skin contact.

Eyes

Safety glasses with perforated sides. Use splash goggles when eye contact due to splashing or spraying liquid is possible. Contact lenses must not be worn.

Remarks

Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Wash thoroughly after handling with soap and water.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Dimethyl Disulfide	US (ACGIH)	TWA	0.5 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Benzene	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
	NIOSH	IDLH	500 ppm	None.
Toluene	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.
n-Hexane	US (ACGIH)	TWA	50 ppm	None.
	US (OSHA)	TWA	500 ppm 1,800 mg/m ³	None.
	NIOSH	IDLH	1,100 ppm	None.
Methyl Mercaptan	US (ACGIH)	TWA	0.5 ppm	None.
	US (OSHA)	CEILING	10 ppm 20 mg/m ³	None.
	NIOSH	IDLH	150 ppm	None.
Ethyl Mercaptan	US (ACGIH)	TWA	0.5 ppm	None.
	US (OSHA)	CEILING	10 ppm 25 mg/m ³	None.
	NIOSH	IDLH	500 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid yellow



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Odor: Pungent.

Odor Threshold: No value available.

pH: Not applicable.

Boiling point/boiling range: ~ 111.11 - 173.89 °C (232 - 345 °F)

Melting/freezing point: < -18.33 °C (< -0.99 °F)

Flash point: ~ 17.78 °C (64 °F)

Autoignition temperature: ~ 219.44 °C (426.99 °F) (ASTME659).

Flammability: Extremely flammable.

Lower explosion limit: ~ 1 vol% (% vol in air).

Upper explosion limit: ~ 7.6 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: 1.10 psia @ 100 deg F

Evaporation rate: Appreciable.

Relative density: 1.052

Relative vapor density: ~ 4.7 @ 21.11 °C (70 °F)(Air = 1.0)

Viscosity: ~ 0.5 mPa.s @ 40 °C (104 °F)

Water solubility: Negligible (Less Than .1 Percent).

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks and open flame.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Product Summary
 See componentsummary.

COMPONENT INFORMATION

- *Disulfides, dialkyl and di-Ph, naphtha sweetening* 68955-96-4

Other information
 No data available.

- *Dimethyl Disulfide* 624-92-0

Acute toxicity

<u>LC50 (Inhl)</u>	rat	3.1 MG/L (805 PPM)	4 HOURS
	rat	1.9 MG/L (500 PPM)	4 HOURS

<u>LD50 (Oral)</u>	rat	190 MG/KG BWT
	rabbit	>2000 MG/KG BWT

Acute effects

Inhalation

No human information is available.

Ingestion

No human information is available.

Skin contact

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures.

Target Organs

Nasal cavity. Skin irritant.

Repeated dose toxicity

Rats exposed to dimethyl disulfide by inhalation for 6 hr/day, 5 days/week for 90 days showed decreased body weight gain, changes in clinical chemistry parameters and reversible microscopic changes in the nasal mucosa (> 10 ppm/0.039 mg/L); reduced food consumption (> 25 ppm/0.096 mg/L); decreased thymus weight and increased adrenal gland weight (125 ppm/0.482 mg/L); and marginal changes in hematology parameters (females at 250 ppm/0.96 mg/L); but no evidence of neurotoxicity. Domestic fowl administered dimethyl disulfide orally at total daily doses of 300 µg for 6 days and 600 µg for 6 days, showed signs of neurotoxicity and hemolytic anemia. Dermal exposure of rabbits to dimethyl disulfide on 5 days/week (10.63 and 106.3 mg/kg bwt/day for 4 weeks; and 1063 mg/kg bwt/day for 2 1/2 weeks) produced mortality in the high dose, lethargy in the mid and high doses, differences in some hematology and clinical chemistry parameters in high dose males, and severe, dose-related skin irritation in all dose groups.

Reproductive effects

No effects on reproductive organs were observed in rats following inhalation of dimethyl disulfide for 90 days at concentrations up to 250 ppm (0.96 mg/L).

Developmental Toxicity

In an inhalation developmental toxicity study in rats administered up to 50 ppm (0.193 mg/L) dimethyl disulfide on gestation days 6 to 15, a reduction in fetal weight and an increase in retarded ossification were seen at 50 ppm, in the presence of maternal toxicity (reduced body weight gain), but there was no evidence of teratogenicity.

Genetic Toxicity

Predominantly negative results were obtained with dimethyl disulfide when tested in vitro (negative in assays for bacterial and mammalian cell gene mutation and bacterial DNA damage and repair, ambiguous positive for chromosome aberrations in human lymphocytes). Negative results were obtained when dimethyl disulfide was evaluated in vivo (mouse



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Developmental Toxicity

micronucleus, unscheduled DNA synthesis).

- *Light sweetened naphtha (petroleum) 64741-87-3*

Other information

No data available.

- *Benzene 71-43-2*

Acute toxicity

<u>LC50 (vapor)</u>	rat	13,700 PPM	4 HOURS
	mouse	9980	8 HOURS
	rat	10000	7 HOURS

LD50 (Skin) rabbit > 8260 MG/KG BWT

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Irritation

Skin

Skin irritant.

Eyes

Severe eye irritant.

Sensitization

No evidence of skin or respiratory sensitization.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered body weight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Developmental Toxicity

is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Toluene* 108-88-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit	> 5000 MG/KG BWT	

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported; an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *n-Hexane* 110-54-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	48,000 PPM	4 HOURS
<u>LD50 (Oral)</u>	rat	28,710 MG/KG	
<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	

Irritation

Eyes

Eye irritant.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Peripheral nervous system Testes.

Repeated dose toxicity

Rabbits exposed by inhalation to 3,000 ppm 8 hours/day for 8 days showed changes in the lungs, emphysema, necrosis of the bronchial epithelium, and atelectasis. Rats continuously exposed to 400 ppm developed anoxopathy, although intermittent exposure to 10,000 ppm 6 hours/day, 5 days/week for 13 weeks caused only mild paranodal axonal swelling. The offspring of rats and mice exposed orally or by inhalation to n-hexane during gestation showed depressed weight gain after birth. This agent also affects male and female reproductive capacity.

Reproductive effects

Exposure to n-hexane may damage the developing fetus.

Developmental Toxicity

Causes productive and embryotoxic effects and is cytotoxic in mammalian and human test systems.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

Exposure of humans to 5,000 ppm n-hexane for 10 minutes causes marked vertigo; exposure to 1,500 ppm results in headache and slight nausea. In industrial settings, exposure to levels exceeding 1,000 ppm have been reported to cause mild symptoms of narcosis. Eye and upper respiratory tract irritation has been reported to occur in humans exposed to 880 ppm n-hexane for 15 minutes. Dermal contact with n-hexane results in immediate irritation characterized by erythema and hyperemia; exposed subjects developed blisters 5 hours following dermal exposure to n-hexane. The neuropathic toxicity of n-hexane in humans is well documented; cases of polyneuropathy have typically occurred in humans chronically exposed to levels of n-hexane ranging from 400 to 600 ppm, with occasional exposures up to 2,500 ppm. Distal symmetrical motor weakness is common in most cases; however, in severely affected individuals, motor weakness may extend to the pelvic and high musculature. Nerve biopsies in affected individuals show swelling of the nerve and thinning of the myelin sheath. Functional neurological disturbances usually progress for a few months after termination of exposure. Although recovery is expected to occur within a year, clinical polyneuropathy has been reported in some cases to remain after 2 years. Blurred vision, restricted visual field, and optic nerve atrophy has been reported to occur in association with n-hexane-induced polyneuropathy.

- *Methyl Mercaptan* 74-93-1

Acute toxicity

<u>LC50 (Inhl)</u>	rat	1.33 MG/L (675 PPM)	4 HOURS
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Acute effects



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Inhalation

May cause headaches. Inhalation may cause CNS depression. May cause irritation of the mucous membranes.

Ingestion

Stream is a gas with a low boiling point; hence, oral exposure and resulting acute toxicity are unlikely.

Skin contact

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures.

Irritation

Skin

There are no known reliable studies regarding systemic toxicity in humans or animals after dermal exposures.

Eyes

May cause eye irritation.

Target Organs

central nervous system (CNS) Mucous membrane irritant. Respiratory system. Eye irritant.

Repeated dose toxicity

Repeated inhalation exposure of rats for 90 days to 57 ppm (0.11 mg/L) methyl mercaptan produced a decrease in body weight gain.

- *Ethyl Mercaptan 75-08-1*

Acute toxicity

<u>LC50 (Inhl)</u>	rat	11.23 MG/L (4420 PPM)	4 HOURS
<u>LD50 (Oral)</u>	rat	682 MG/KG BWT	
	rat	>2000 MG/KG BWT	

Acute effects

Inhalation

No human information is available.

Ingestion

Harmful if swallowed.

Skin contact

No human information is available.

Irritation

Skin

No human information is available.

Eyes

No human information is available.

Target Organs

Nasal cavity.

Repeated dose toxicity

In a poorly reported inhalation study, rabbits, rats and mice exposed to ethyl mercaptan for 5 months at 0.10 mg/L (40 ppm), showed minimal deviations in cardiovascular system regulation and organ weights. Human subjects exposed to ethyl mercaptan at 0.010 mg/L (4 ppm) for 3 hr/day during 5-10 days produced a rise in olfactory threshold, nausea, irritation of



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Repeated dose toxicity

mucous membranes, and fatigue; while exposure at 0.001 mg/L (0.5 ppm) produced no unpleasant symptoms.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

COMPONENT INFORMATION

- *Disulfides, dialkyl and di-Ph, naphtha sweetening* 68955-96-4

Ecotoxicity

no data available

Environmental fate and pathways

No data available.

- *Dimethyl Disulfide* 624-92-0

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Light sweetened naphtha (petroleum)* 64741-87-3

Ecotoxicity

No data available.

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

No data available.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 5.3 - 21.6 mg/l

LC50 / 96 HOUR *Pimephales promelas* 14.0 - 15.6 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 28.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS *Daphnia magna*. 10 mg/l

EC50 / 48 HOUR *Ceriodaphnia dubia* 17.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 28 - 100 mg/l

Toxicity to microorganisms

IC50 / 24 HOURS *Nitrosomonas* sp. 13 mg/l

Chronic toxicity to fish

LOEC / 32 DAY *Pimephales promelas* 1.6 mg/l

Chronic toxicity to aquatic invertebrates

EC50 / 7 DAY *Ceriodaphnia dubia* 11.6 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 55 mg/l

LC50 / 96 HOUR *Carassius auratus* 22.8 mg/l

LC50 / 96 HOUR *Pimephales promelas* 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 11.5 - 14.9 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY Daphnia magna. 1.0 mg/l

NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *n*-Hexane 110-54-3

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 4.14 mg/l

LC50 / 96 HOUR Pimephales promelas 2.5 mg/l

LC50 / 96 HOURS Lepomis macrochirus 4.12 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 3.87 mg/l

Environmental fate and pathways

Photolysis, hydrolysis or bioconcentration of *n*-hexane are not expected to be an important environmental fate processes. Biodegradation of *n*-hexane may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A Koc range of 1250 to 4100 indicates a low to slight mobility class in soil for *n*-hexane. In aquatic systems *n*-hexane may partition from the water column to organic matter contained in sediments and suspended materials. Rapid volatilization from environmental waters is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Bioaccumulation: This material is not expected to bioaccumulate.

- *Methyl Mercaptan* 74-93-1

Ecotoxicity

No data available.

Environmental fate and pathways

Other adverse effects

No Data Available.

- *Ethyl Mercaptan* 75-08-1

Ecotoxicity

No data available.

Environmental fate and pathways

Other adverse effects

No Data Available.

13. DISPOSAL CONSIDERATIONS

Recover waste liquids for beneficial recycle/reuse. Treatment, storage, transportation and disposal must be in accordance with EPA or State regulations under the authority of Resource,Conservation and Recovery Act (40 CFR PARTS 260-271). Do not flush to surface waters or sanitary sewer system. A potential disposal method is incineration.

14. TRANSPORT INFORMATION

Proper shipping name	FLAMMABLE LIQUIDS, N.O.S.
Reportable quantity	Benzene TOLUENE
ID No.	UN1993
Hazard class	3
Packing group	II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

Australia	AICS
Canada	NDSL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Benzene		10 lbs
Toluene		1000 lbs
n-Hexane		5000 lbs
Methyl Mercaptan	500lbs	100 lbs

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
Benzene	0.1%
Toluene	1.0%
n-Hexane	1.0%

State Reporting

Known to the State of California to cause cancer.

71-43-2 Benzene (December 11, 2009)

Known to the State of California to cause birth defects.

71-43-2 Benzene (December 11, 2009)

108-88-3 Toluene

Known to the State of California to cause reproductive toxicity in males.

71-43-2 Benzene (December 11, 2009)

Known to the State of California to cause reproductive toxicity in females.

108-88-3 Toluene (December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

624-92-0 Dimethyl Disulfide
 71-43-2 Benzene
 108-88-3 Toluene
 110-54-3 n-Hexane
 74-93-1 Methyl Mercaptan
 75-08-1 Ethyl Mercaptan

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

624-92-0 Dimethyl Disulfide
 71-43-2 Benzene
 108-88-3 Toluene
 110-54-3 n-Hexane
 74-93-1 Methyl Mercaptan



MATERIAL SAFETY DATA SHEET

MSDS No.: BE100
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

DSO

75-08-1 Ethyl Mercaptan

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

624-92-0 Dimethyl Disulfide
 71-43-2 Benzene
 108-88-3 Toluene
 110-54-3 n-Hexane
 74-93-1 Methyl Mercaptan
 75-08-1 Ethyl Mercaptan

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Last revision: Logo change. November 3 2010

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet

HoustonRefining

A Lyondell Company

AP1828
HFR # 220

Coker Light Gas Oil (CLGO)

Company

Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

Material Safety Data Sheet

MSDS No. AP1828
Revision Date 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent to slightly opaque, slightly yellow to slightly amber. **Odor** Characteristic, kerosene-like.

WARNING! Combustible liquid; vapor may cause flash fire. Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.
Liquid contact may cause minimal to mild eye irritation and/or mild to severe skin irritation and inflammation.
May be harmful if inhaled or absorbed through the skin.
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects.
May be harmful or fatal if ingested. Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia.
Contains Naphthalene and Polynuclear Aromatic Hydrocarbons. Based upon laboratory animal studies, may cause skin cancer following extended contact or inhalation.
Mutagenic hazard; may cause genetic damage.
Based upon animal testing, may adversely affect reproduction.
Spills may create a slipping hazard.
If used as a fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects.
Long-term exposure to fuel exhaust particulates may cause cancer.

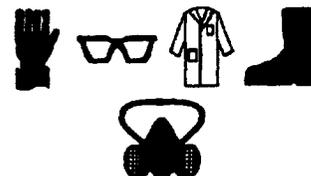
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details

**SECTION 1: IDENTIFICATION****Trade Name** Coker Light Gas Oil (CLGO)**Product Number** 1828018280**CAS Number** 64741-82-8**Product Family** Petroleum Hydrocarbon Middle Distillate

Synonyms CLGO; Coker LGO; Medium Distillate from a Delayed Coker Unit; Thermocracked Light Gas Oil; Light Thermocracked Distillate; Light Thermal Cracked Distillate (Petroleum); Thermal-cracked Middle Distillate; Cracked Middle Distillate Blending Stock; C9-C22 Petroleum Hydrocarbons.

Business Contact

Product Safety 800-700-0946

24 Hour Emergency Contact

CHEMTREC 800-424-9300

CANUTEC-Canada 613-996-6666

LYONDELL 800-245-4532

Coker Light Gas Oil (CLGO)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Light Thermal Cracked Distillate (Petroleum)	64741-82-6	100
2) Xylenes (Mixed Isomers)	1330-20-7	0-1.5
3) Trimethylbenzene (mixed isomers)	25551-13-7	0.5-1.5
4) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	0.5-2
5) Naphthalene	91-20-3	1-3
6) C10-C11 Alkylbenzenes	70693-06-0	1-5
7) C11 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	15-25
8) C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	20-40
9) Biphenyl (Diphenyl)	92-52-4	1-5
10) C12-C21 Aromatic Hydrocarbons	Mixture	10-20
11) C13-C22 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	20-35
12) Polynuclear Aromatic Hydrocarbons (4- to 6-member condensed-ring type)	68487-58-6	0.1-1

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing mist or vapors may irritate the mucous membranes of the nose, throat, bronchi, and lungs, and may cause transient central nervous system (CNS) depression. CNS symptoms include headache, dizziness, nausea, intoxication, blurred vision, slurred speech, flushed face, confusion, weakness, fatigue, loss of consciousness, convulsions, coma, and death, depending on the concentration and/or duration of exposure.
Eye Contact	Animal test results on similar materials suggest that this product can cause minimal to mild eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness.
Skin Contact	Animal test results on similar materials suggest that this product can cause mild to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, esophagus, and stomach. It can be readily absorbed by the stomach and intestinal tract. Ingestion can produce a burning sensation of the mouth and esophagus and central nervous system depression. Symptoms of CNS depression may include nausea, vomiting, dizziness, staggering gait, drowsiness, shallow rapid pulse, diarrhea, restlessness, sedation, inadequate respiratory function, and heart irregularities. Higher doses may cause loss of consciousness and delirium prior to the onset of convulsions, coma, and death (see "inhalation" above). A lethal dose may be as low as one-half ounce for a child and one ounce for an adult human.

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration of a small amount of liquid can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary This light thermal cracked distillate is a middle distillate similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter part of the 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced.

Based upon animal testing, the C8 aromatic hydrocarbon components (xylene isomers) might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. And, the C9 aromatic hydrocarbons (cumene, n-propylbenzene, trimethylbenzenes, indene, and ethylmethylbenzenes) are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period.

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational xylene exposures have caused auditory nerve degeneration.

Coker Light Gas Oil (CLGO)

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic.

Biphenyl (Diphenyl) may cause liver and/or nerve damage. (See Section 11.)

- Conditions Aggravated by Exposure** Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases, and women attempting to conceive should avoid exposure.
- Target Organs** This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the blood, liver, kidneys, and reproductive system.
- Carcinogenic Potential** This material contains naphthalene and small concentrations 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNA's) at concentrations above 0.1%. Naphthalene is considered possibly carcinogenic to humans by IARC. Some PNA compounds has been determined to be carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification			
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>
						Pyrophoric	<input type="checkbox"/>
						Water-reactive	<input type="checkbox"/>
						Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
- Skin Contact** Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
- Ingestion** Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Coker Light Gas Oil (CLGO)

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-II or IIIA Combustible Liquid. Highly or moderately combustible!		
Flash Point Method	CLOSED CUP: 52° to 82°C (125° to 180°F) (Pensky-Martens [ASTM D-93]).		
Lower Flammable Limit	AP 0.6%	Upper Flammable Limit	AP 7.5%
Autotemperature	AP 257°C (495°F)		
Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur.		
Special Properties	<p>Combustible Liquid! This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.</p>		
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>		
Protection of Fire Fighters	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.</p>		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid! Release causes an potential fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

Coker Light Gas Oil (CLGO)

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause a potential fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Coker Light Gas Oil (CLGO)

- Respiratory Protection** For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).
- General Comments** Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)	TWA: 100 (mg/m ³) from ACGIH (TLV) [Proposed] - SKIN
2) Xylenes (mixed isomers)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 100 (ppm) from OSHA (PEL) [Proposed]
3) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) TWA: 25 (ppm) from OSHA (PEL) [Proposed]
4) Naphthalene	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed]
5) Biphenyl (Diphenyl)	TWA: 10 (ppm) from OSHA (PEL) TWA: 0.2 (ppm) from ACGIH (TLV) TWA: 0.2 (ppm) from OSHA (PEL) [Proposed]
6) Coal tar pitch volatiles, as benzene solubles	TWA: 0.2 (mg/m ³) from ACGIH (TLV) TWA: 0.2 (mg/m ³) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent to slightly opaque, slightly yellow to slightly amber.	Odor	Characteristic, kerosene-like.
Specific Gravity	0.84 to 0.88 at 60°F (Water = 1)	pH	Not applicable.	Vapor Density	5.0 to 5.2 (Air = 1 at 70°F)
Boiling Point/Range	140° to 370°C (285° to 700°F) [ASTM D-2887]			Melting/Freezing Point	< -15°C (< 5°F) [ASTM D-97]
Vapor Pressure	< 0.1 psia at 38°C (100°F).			Viscosity (cSt @ 40°C)	3.85 to 7.35 [ASTM D-445]
Solubility in Water	Negligible to slightly soluble in cold water (0.005% to 0.04%).			Volatile Characteristics	Slight; some Volatile Organic Compounds (VOCs) present at 302°F (150°C).
Additional Properties	Alkane, isoparaffin, and Cycloalkane Hydrocarbons Content = 70 to 85 Wt.% [ASTM D-1319]; C8-C22 Aromatic Hydrocarbon Content = 15 to 30 Wt.% [ASTM D-1319]; Average Density at 60°F = 7.163 lbs./gal. [ASTM D-2161]; Cetane Number = 40 to 45 [ASTM D-613 or D-976]; Saybolt Viscosity = 38 to 50 SUS at 100°F [ASTM D-2161]; Sulfur Content = 1.3 to 1.9 Wt.% [ASTM D-2622]; Ash Content = < 0.05 Wt.% [ASTM D-482]; 90% Boiling Point Temperature = 600° to 625°F (315° to 330°C) [ASTM D-86]; Evaporation Rate = < 0.1 when n-Butyl acetate = 1.0.				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

Coker Light Gas Oil (CLGO)

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data**Straight-run Middle Distillate (Petroleum) [a similar material]:**

GAS (LC₅₀): Acute: 1.72 mg/L for 4 hours [Male Rat] - Pulmonary edema.
 GAS (LC₅₀): Acute: 1.82 mg/L for 4 hours [Female Rat] - Pulmonary edema.
 ORAL (LD₅₀): Acute: > 5,000 mg/kg [Rat screen] - Diarrhea, hypoactivity, and somnolence.
 DERMAL (LD₅₀): Acute: > 2,000 mg/kg [Rabbit screen].
 BUEHLER DERMAL: Acute. Non-sensitizing [Guinea Pig].
 INTRAVENOUS (LD₅₀): Acute: 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma.
 28-Day DERMAL: Subchronic: Moderate to severe irritation at 200 to 2,000 mg/kg with no other treatment-related clinical effects observed.

Xylenes:

ORAL (LD₅₀): Acute: 4,300 mg/kg [Rat].
 GAS (LC₅₀): Acute: 4,550 ppm for 4 hours [Rat].
 DERMAL (LD₅₀): Acute: 14,100 uL/kg [Rabbit].
 SUBCUTANEOUS (LD₅₀): Acute: 1,700 mg/kg [Rat].
 INTRAPERITONEAL (LD₅₀): Acute: 2,459 mg/kg [Rat].
 INTRAPERITONEAL (LD₅₀): Acute: 1,548 mg/kg [Mouse].

Trimethylbenzenes:

ORAL (LD₅₀): Acute: 8,970 mg/kg [Rat].

1,2,4-Trimethylbenzene:

ORAL (LD₅₀): Acute: 5,000 mg/kg [Rat].
 GAS (LC₅₀): Acute: 18,000 mg/m³ for 4 hours [Rat].

Ethylmethylbenzenes (Ethyltoluenes):

GAS (LC₅₀): Acute: 50,000 mg/m³ for 2 hours [Cat].
 GAS (LC₅₀): Acute: 54,000 mg/m³ for 4 hours [Mouse].

Naphthalene:

ORAL (LD₅₀): Acute: 490 mg/kg [Rat].
 ORAL (LD₅₀): Acute: 533 mg/kg [Mouse].
 ORAL (LD₅₀): Acute: 1,200 mg/kg [Guinea Pig].
 SUBCUTANEOUS (LD₅₀): Acute: 969 mg/kg [Mouse].
 INTRAVENOUS (LD₅₀): Acute: 100 mg/kg [Mouse].
 INTRAPERITONEAL (LD₅₀): Acute: 150 mg/kg [Mouse].

Biphenyl (Diphenyl or 1,1'-Biphenyl):

GAS (TC₅₀): Acute: 4,400 ug/m³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting.
 ORAL (LD₅₀): Acute: > 2,600 mg/kg [Cat screen].
 ORAL (LD₅₀): Acute: 2,400 mg/kg [Rat and Rabbit].
 ORAL (LD₅₀): Acute: 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea.
 DERMAL (LD₅₀): Acute: > 5,010 mg/kg [Rabbit screen].
 INTRAVENOUS (LD₅₀): Acute: 56 mg/kg [Mouse].

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 700°F., commonly referred to as "middle distillates, including straight-run middle distillate" have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Untreated, cracked, and vacuum distillates including straight-run middle distillate have been identified as skin carcinogens by IARC. These similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Untreated (straight-run, cracked, and vacuum) middle distillates produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) assay, the in-vivo mouse SCE assay, and the in-vivo rat bone marrow cell chromosome aberrations assay; however, the in-vitro mouse lymphoma assay with and without S9 activation produced both mixed positive and negative responses. The significance of these study results to human health is unclear.

Studies with mice and rats have shown that some petroleum middle distillate fuels similar to this material have caused liver tumors and kidney damage and/or tumors. However, the kidney effects were sex hormone dependent and not seen in similar studies involving Guinea pigs, dogs, or monkeys. Also, the significance of the liver tumors in rodents is highly speculative relative to humans.

Coker Light Gas Oil (CLGO)

Studies with mice and rats have also shown that chronic exposures (8 hours/day, 7 days/week, for 24 months) to **unfiltered diesel fuel exhaust** produced lung tumors and lymphomas. On the basis of these studies, NIOSH recommended that **complete diesel exhaust** be regarded as a "potential carcinogen"

Numerous epidemiology studies have been carried out to test the hypothesis that lung and/or bladder cancers are associated with chronic exposure to **diesel engine exhaust**. The most comprehensive case-control and retrospective cohort studies on U.S. railroad workers showed an increased risk for lung cancer and this risk significantly increased with extended duration exposures. There are some indications that an elevated frequency of bladder cancer amongst bus and truck drivers may be due to diesel engine exhaust exposure

Overexposure to **xylene isomers** may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage, and narcosis. Effects may be increased by the consumption of ethanol (alcoholic beverages) which impairs clearance from adipose (fat) tissues. Also, ototoxicity has been associated with chronic overexposure to xylene. An inhalation study with laboratory rats also indicated an association between elevated mixed xylene exposures and hearing loss. Lung inflammation and liver damage were identified as health effects in chronic studies using guinea pigs

Several animal studies using pregnant rodents have shown that **mixed xylene isomers and ethylbenzene (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene (dimethylbenzenes)** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays. Animal inhalation and feeding studies have also associated embryo and fetotoxicity with maternally toxic dose exposures of mixed xylene isomers and ethylbenzene. Fetal toxicity included increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes. The significance of these animal study results to humans is not known.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. Its TC_{10} for humans 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation studies with rats, four of ten animals died after exposures of 2,400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. **Mesitylene (1,3,5-Trimethylbenzene)** inhalation at concentrations of 1.5, 30, and 60 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity

Ethylmethylbenzenes are primary skin irritants. Overexposure has been associated with kidney damage and increased blood cholinesterase levels. In inhalation developmental studies, indene and other C9 aromatic hydrocarbons have been associated with decreased fetal and newborn pup weights

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction of red blood cells (*hemolytic and aplastic anemia*), and kidney damage (*jaundice*), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in eight of 21 workers exposed to elevated levels of naphthalene vapors for five years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Based upon animal studies, naphthalene may cause fetal toxicity or damage and decreased spleen weights in pregnant female mice

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay of naphthalene. The study was conducted in male and female F344/N rats at exposure concentrations of 0, 10, 30, and 60 ppm. No significant effects were observed at the 10 ppm levels. However, compared to chamber controls, there was a dose-related increase in tumors generated at the 30 and 60 ppm levels in both males and females. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas, and non-neoplastic lesions of the nose were observed when compared to chamber controls. Additionally, in

Coker Light Gas Oil (CLGO)

cytogenic tests with Chinese hamster ovary cells, naphthalene induced significant increases in sister chromatid exchanges with and without metabolic activation (S9) and chromosomal aberrations with S9. The relevance of these findings to human health is unclear; however, based upon this data, IARC has determined naphthalene to be possibly carcinogen to humans (Class 2B).

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage. Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this kerosene, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Volatile aromatic hydrocarbon components (trimethylbenzenes, ethylmethylbenzenes, naphthalene, and biphenyl) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalius cephalus*), similar middle distillates and some of this material's components showed a 96-hour TL_{Ms} (Median Toxic Limit) of from 10 ppm to 20 ppm in ambient saltwater. Also, 96-hour LC₅₀ testing produced results from 20 ppm to 320 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Banded Killifish (*Fundulus diaphanus*), American Eel (*Anguilla rostrata*), White Perch (*Perca fluviatilis*), and Striped Mullet (*Mugil cephalus*). Based upon actual spill incident investigations, similar middle distillates have been shown to bioaccumulate in tissues of various fish from less than 1 to 10 ppm levels.

Environmental Fate

This middle distillate is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

Coker Light Gas Oil (CLGO)

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT) only when transported in bulk containers, via vessel, or via aircraft.		
Proper Shipping Name	Gas Oil or Petroleum distillates, n.o.s. (Naphthalene, Biphenyl) or Combustible liquid, n.o.s. (Naphthalene, Biphenyl) for bulk containers; it may or may not be regulated in non-bulk container shipments. If this product has a flash point temperature between 100° and 140°F (37.8° to 60.5°C), it is classified as a "Flammable liquid". And, if its flash point temperature is between 141° and 200°F (60.5° to 93°C), it is classified as a DOT "Combustible liquid" for bulk shipments. However, according to 49 CFR 173.150(f)(2), certain transportation-related requirements, such as labeling, may not apply to this product when shipped in non-bulk packaging of less than 119 gallons capacity. Also, pursuant to 49 CFR 173.150(b) and 173.150(f)(2) and (3), "limited-quantities" offered for or transported via aircraft may be subject to DOT regulation.		
Hazard Class	DOT Class: "3" (Flammable liquid) or "COMBUSTIBLE LIQUID" [with a flash point greater than 60.5° C (>141° F)] for bulk containers.	Packing Group(s) UN/NA ID	PG III or Not applicable. UN1202 or UN1268 or NA1993 or Not applicable.
Reportable Quantity	The Reportable Quantity (RQ) substance component in this material which might require DOT HAZMAT bill-of-lading display is Naphthalene and Xylenes.		
Placards	Emergency Response Guide No. 128 or Not applicable		
		HAZMAT STCC No.	4912218 or 4910256 or 4914112
		MARPOL III Status	All impacted components were delisted as DOT "Marine Pollutants" per 86 FR 120 (page 33413) dated 6/21/2001.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: 1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 96-63-6] concentration: 0.25 to 1.0% Naphthalene [CAS No. 91-20-3] concentration: 1 to 3% Biphenyl (Diphenyl) [CAS No. 92-62-4] concentration: 1 to 5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 1.5% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 0.1% Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0.1 to 0.5% Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 3% Benzo[a]phenanthrene (Chrysene) [CAS No. 218-01-9] concentration: 0.0005 to 0.002%.

HoustonRefining

A Lyondell Company

Coker Light Gas Oil (CLGO)

CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material, especially if used as a fuel, might be considered to contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it might be subject to requirements of California Health & Safety Code Section 25249.5: Naphthalene [CAS No. 91-20-3] concentration: 1 to 3% Benzo[a]phenanthrene (Chrysene) [CAS No. 218-01-9] concentration: 0.0005 to 0.002% Diesel Engine Exhaust (following combustion).
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component of this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare": Xylenes (mixed) [CAS No. 1330-20-7], Ethylbenzene [100-41-4], Cumene [98-82-8], and Biphenyl (Diphenyl) [CAS No. 92-52-4].

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	2.1
Revision Date	11/01/06

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



MATERIAL SAFETY DATA SHEET

HR# 1,2,0

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

AP2050

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: LT CYCLE OIL

Number: 00000000000016093

Chemical characterization: Petroleum Hydrocarbon Middle Distillate

CAS-No.: 64741-59-9

Synonyms: Light Vacuum Gas Oil (Petroleum), LCO, FCCU, FCCU Light Cycle Oil, Fluid Catalytic Cracker Unit Light Cycle Oil, Middle Distillate Cuter Oil, Untreated Diesel fuel Blending component, Light Catalytic Cracked distillate (Petroleum), C9- C25 Petroleum Hydrocarbons

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

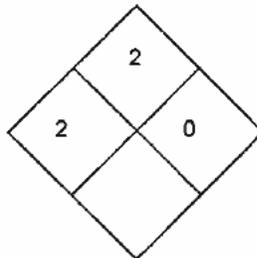
Signal Word

WARNING.

Hazards

Combustible liquid. Harmful if inhaled or absorbed through the skin. May cause irritation to skin, eyes, and respiratory tract. May cause central nervous system effects. Contains material which can cause cancer. May cause genetic defects. This material may contain polynuclear aromatic hydrocarbons (PAH), some of which induced skin tumors on laboratory animals upon prolonged and repeated exposure.

NFPA®



HMIS®

Health	*	1
Flammability		2
Physical Hazard		0

Physical state

liquid

Color

Transparent to light yellow. Yellow to amber.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

Odor

Gasoline or naphtha odor.

Odor Threshold

No value available.

Potential health effects

Routes of exposure

Skin. Eye. Inhalation.

Acute effects

Inhalation hazard. May cause drowsiness and dizziness.

- *1,1'-Biphenyl 92-52-4*
No known acute health effects.
- *Trimethyl benzene 25551-13-7*
CNS depressant. Aspiration hazard.
- *Naphthalene 91-20-3*

May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus.

Skin

May produce skin irritation. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Inhalation

Can cause pulmonary edema if aspirated into lungs.

Eyes

May cause moderate irritation, including burning sensation, tearing, redness or swelling. May cause eye irritation. Effects of eye irritation are reversible.

Ingestion

Aspiration may cause lung damage.

Chronic effects

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. Prolonged or repeated exposure to vapors may cause lung damage.

- *1,1'-Biphenyl 92-52-4*

Chronic exposure may result in central nervous system and gastrointestinal system disturbances. Prolonged and repeated exposure to vapors may cause damage to the Central Nervous System, kidneys, liver, and adrenal glands. May cause dermatitis by defatting the skin from prolonged or repeated contact.

- *Trimethyl benzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *Naphthalene 91-20-3*

Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Potential Cancer Hazard, see section 11.

Aggravated Medical Condition

Any pre-existing disorders or diseases of the: central nervous system (CNS) skin liver kidney respiratory system



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Distillates (Petroleum), light catalytic cracked	64741-59-9	265-060-4	100.0
1,1'-Biphenyl	92-52-4	202-163-5	1.0 <= 5.0
Trimethyl benzene	25551-13-7	247-099-9	0.0 <= 1.5
Naphthalene	91-20-3	202-049-5	1.0 <= 3.0

Typical composition

4. FIRST AID MEASURES

General advice

May cause cancer. Harmful by inhalation. Harmful: danger of serious damage to health by prolonged exposure in contact with skin. Aspiration into the lungs during swallowing or vomiting can cause lung damage, possibly leading to chronic lung dysfunction or death. Causes skin irritation. Liquid, vapors or mist may be irritating to eyes, skin and respiratory tract.

Possible cardiac sensitization. Vapors may cause drowsiness and dizziness. Ingestion may cause CNS effects, discomfort and irritation of the gastrointestinal tract, nausea, vomiting, and diarrhea.

Repeated exposure may cause skin dryness or cracking. Always observe self-protection methods. Move out of dangerous area. Do not leave the victim unattended. Remove contaminated shoes and clothing. Get medical attention immediately. Show this material safety data sheet to the doctor in attendance.

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. DO NOT use gasoline, kerosene, solvents, or harsh abrasive skin cleaners. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

Do not induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Never give anything by mouth to an unconscious person. Immediately seek medical attention.

Notes to physician

Do not induce vomiting. Risk of damage to lungs exceeds poisoning risk. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class II combustible liquid.

Flash point

> 61 °C (> 141.8 °F)

Autoignition temperature

>= 225 °C (>= 437 °F)

Lower explosion limit

Specific data not available.

Upper explosion limit

Specific data not available.

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemical, foam, or carbon dioxide or water fog Sand. LARGE FIRES: Water spray Water fog. Foam Dry chemical Carbon dioxide (CO₂) Sand Apply water carefully to avoid frothing/steam explosion.

Unsuitable extinguishing media

Do not use a solid water stream as it may scatter and spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

Move containers from fire area if you can do it without risk. Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Contents under pressure and can explode when exposed to heat or flames. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. Releases flammable vapors below normal ambient temperatures. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Assure good ventilation to prevent flammable vapor formation. Vapors may travel long distances along the ground before reaching a source of ignition and flashing back. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE). The product will float and can be reignited on surface water. Apply aqueous extinguishing media carefully to any molten/liquid material to prevent frothing/steam explosion. Prevent fire extinguishing water from contaminating surface water or the ground water system. Notify authorities immediately if liquid enters sewer/public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Combustible liquid. Release can cause fire or explosion. Evacuate/limit access. A vapor suppressing foam may be used to reduce vapors. Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Stop leak if you can do it without risk. Do not touch or walk through spilled material. Can also be slippery on hard, smooth walking area. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material. For



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

Spills and leaks

large spills: Limit access to essential personnel. Water spray may reduce vapor, but may not prevent ignition in closed spaces.

Prevent entry into waterways, sewers, basements or confined areas. If the product contaminates rivers and lakes or drains inform respective authorities.

7. HANDLING AND STORAGE

Handling

Ensure all equipment is electrically grounded before beginning transfer operations. Check atmosphere for explosiveness and oxygen deficiencies. If sulfur compounds are suspected to be present in the product, check the atmosphere for hydrogen sulfide (H₂S) content.

Eliminate every possible source of ignition. Spilled material can make walking hazardous, potentially causing falls and serious injury. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Do not use compressed air for filling, discharging or handling. Use good housekeeping practices during use, storage, transfer, and handling. Do not handle near heat, sparks, or flame. Avoid contact with incompatible agents. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Do not enter storage area unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded. Electrostatic charges may be generated as a result of flow or agitation. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Always keep nozzle in contact with the container throughout the loading process. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Ensure that all relevant regulations regarding explosive atmospheres, and handling and storage facilities of flammable products are followed. Use only non-sparking tools. Handle empty containers with care; vapor/residue may be flammable. Do not pressurize or expose empty containers to open flame, sparks, or heat. Observe precautions pertaining to confined space entry.

Storage

Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Hydrogen sulfide (H₂S) and other hazardous vapors may evolve and collect in the headspace of storage tanks and other enclosed vessels. H₂S is an extremely flammable and a highly toxic gas. Store in original container. Store closed drums with bung in up position. Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room. Bonding and grounding measures may not be enough if nonconductive flammables are involved. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Storage area layout, tank design, equipment and operating procedures must comply with the relevant European, national or local legislation. Cleaning, inspection and maintenance of the internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Engineering controls, preferably enclosed systems, should be used whenever feasible to maintain exposures below acceptable criteria. When such controls are not feasible, or sufficient to achieve full conformance, other engineering controls such as local exhaust ventilation should be used. Provide local exhaust or general room ventilation to minimize exposure to vapors. Electrical equipment should be grounded and conform to applicable electrical code. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Skin



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

Skin

Avoid contact with skin. Wear insulated gloves if contact with liquid is possible. Skin should be washed after contact. Wear chemical resistant gloves such as: Nitrile. The suitability for a specific workplace should be discussed with the producers of the protective gloves. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Eyes

Safety glasses with perforated sides. Wear chemical safety goggles plus full face shield to protect against splashing when appropriate (ANSI Z87.1).

Remarks

Wash hands before eating, drinking, smoking, or using toilet facilities. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Use good personal hygiene practices.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
1,1'-Biphenyl	US (ACGIH)	TWA	0.2 ppm	None.
	US (OSHA)	TWA	0.2 ppm 1 mg/m ³	None.
	NIOSH	IDLH	100 mg/m ³	None.
Trimethyl benzene	US (OSHA)	TWA	25 ppm	None.
	US (ACGIH)	TWA	25 ppm	None.
Naphthalene	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	US (OSHA)	TWA	10 ppm 50 mg/m ³	None.
	NIOSH	IDLH	250 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Transparent to light yellow., Yellow to amber.

Odor: Gasoline or naphtha odor.

Odor Threshold: No value available.

pH: Not applicable.

Boiling point/boiling range: 185 - 372 °C (365 - 701.6 °F)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

Melting/freezing point: -40 - 6 °C (-40 - 42.8 °F)

Flash point: > 61 °C (> 141.8 °F)

Autoignition temperature: >= 225 °C (>= 437 °F)

Flammability: OSHA/NFPA Class II combustible liquid.

Lower explosion limit: Specific data not available.

Upper explosion limit: Specific data not available.

Explosive properties: Not explosive (No chemical groups associated with explosive properties.)

Oxidizing properties: Not considered an oxidizing agent.

Vapor pressure: 0.4 kPa @ 40 °C (104 °F) (Based on Vacuum Residues) < 0.1 mm Hg

Evaporation rate: Slight.

Relative density: 0.89 - 0.99 @ 15 °C (59 °F)

Relative vapor density: not determined

Viscosity: 3.65 - 7.35 mPa.s @ 40 °C (104 °F)
 >= 1.1 mm²/s @ 40 °C (104 °F)

Water solubility: 0.05 - 0.4 g/l Slightly soluble in cold water.

Partition coefficient: n-octanol/water: Not applicable.

Other physico-chemical properties: No information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks, open flames and strong oxidizing conditions. Contact with strong bases. Electrostatic charges may be generated as a result of flow or agitation.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Incomplete combustion can result in the production of carbon monoxide, carbon dioxide and other toxic gases. May also include hydrogen sulfide, sulfur oxides or sulfuric acid.

Hazardous polymerization

Not expected to occur.

11. TOXICOLOGICAL INFORMATION



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

Product information

Acute toxicity			
LC50 (aerosol)	rat	4.65 MG/L	4 HOURS
LD50 (Oral)	rat	3200 MG/KG	
LD50 (Skin)	rabbit	>2000 MG/KG	

Acute effects

Inhalation

Predicted exposure concentration Harmful by inhalation. Stream expected to be harmful by inhalation based on toxicity information for streams having components in common with this stream. Can cause pulmonary edema if aspirated into lungs.

Ingestion

Predicted exposure concentration Stream expected to have a low order of acute oral toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Irritating to skin. Stream expected to be irritating to the skin based on toxicity information for streams having components in common with this stream.

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Skin. Central nervous system. Lungs

COMPONENT INFORMATION

- *Distillates (Petroleum), light catalytic cracked* 64741-59-9

Other information

See Product Summary

- *1,1'-Biphenyl* 92-52-4

Acute toxicity			
LCLo	Human	4400 UG/M ³	4 HOURS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

<u>LD50 (Oral)</u>	rat	3280 MG/M3
	rabbit	2400 MG/M3
		> 2600 MG/KG
	mouse	1900 MG/KG

<u>LD50 (Skin)</u>	rabbit	> 5010 MG/KG
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Target Organs
 Liver.

- *Trimethyl benzene* 25551-13-7

Acute toxicity

<u>LD50 (Oral)</u>	rat	8970 MG/KG
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Irritation

Skin

Skin irritant.

- *Naphthalene* 91-20-3

Acute toxicity

<u>LC50 (Inh)</u>	rat	>340 MG/M3	4 HOUR
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<u>LD50 (Oral)</u>	rat	490 MG/KG
	mouse	533 MG/KG
	guinea pig	1200 MG/KG

Irritation

Skin

May be irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Repeated inhalation or ingestion of naphthalene causes methemoglobinemia*

Developmental Toxicity

Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bwt/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bwt/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice).

Genetic Toxicity

Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bwt orally or 250 mg/kg bwt by intraperitoneal injection.

Carcinogenicity

The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).

12. ECOLOGICAL INFORMATION

Product information



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

Ecotoxicity

Toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

Acute Fish toxicity

LL50 / 96 HOURS Fish 0.156 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Acute toxicity to aquatic invertebrates

EL50 / 48 HOURS Daphnia magna (Water flea) 0.319 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Toxicity to aquatic plants

EL50 / 72 HOURS Pseudokirchneriella subcapitata (green algae) 0.202 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Toxicity to microorganisms

NOELR / 40 HOURS Tetrahymena pyriformis (ciliated protozoa) 0.241 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOEL / 14 d Oncorhynchus mykiss 0.029 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to aquatic invertebrates

NOEL / 21 d Daphnia magna (Water flea) 0.053 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Partitioning mainly to air.

Predicted distribution to environmental compartments: The product will be dispersed amongst the various environmental compartments (soil/ water/ air).

Persistence and degradability

Biodegradation: Not expected to be biodegradable. Not expected to be hydrolytically unstable. Will not undergo photolysis

Bioaccumulation: This material may bioaccumulate.

COMPONENT INFORMATION

- *Distillates (Petroleum), light catalytic cracked 64741-59-9*

Ecotoxicity

Acute Fish toxicity

LL50 / 79 mg/l

Acute toxicity to aquatic invertebrates

EL50 / Daphnia magna (Water flea) 2 mg/l

Toxicity to aquatic plants

ErL50 / algae 3.3 mg/l

NOEL / algae < 1 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

Summary: No Data Available.

Environmental fate and pathways

- *1,1'-Biphenyl* 92-52-4

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Naphthalene* 91-20-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS rainbow trout. 26 mg/l
 Summary: Very toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 21.9 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: Naphthalene has a moderate tendency to bioaccumulate although fish and microorganisms readily metabolize it.

13. DISPOSAL CONSIDERATIONS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

The product should not be allowed to enter drains, water courses or the soil. Can be incinerated, when in compliance with local regulations. Proper grounding procedures to avoid static electricity should be followed. Contaminated product, soil or water should be considered dangerous due to potential evolution of flammable vapor.

14. TRANSPORT INFORMATION

Proper shipping name Petroleum distillates, n.o.s. (TRIMETHYLBENZENES)
Reportable quantity BIPHENYL
 NAPHTHALENE
ID No. UN1268
Hazard class 3
Packing group III

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AKCS
Canada	DSL
China	IECS
European Union	EINECS
Korea	ECL
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

Component	TPQ	RQ
1,1' -Biphenyl		100 lbs
Naphthalene		100 lbs

SARA 313

Component	Reporting Threshold
1,1' -Biphenyl	1.0%
Naphthalene	0.1%

State Reporting

Known to the State of California to cause cancer.

91-20-3 Naphthalene (December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

92-52-4 1,1' -Biphenyl
 25551-13-7 Trimethyl benzene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE105
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/22/2011

LT CYCLE OIL

91-20-3 Naphthalene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

92-52-4 1,1'-Biphenyl
 25551-13-7 Trimethyl benzene
 91-20-3 Naphthalene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

92-52-4 1,1'-Biphenyl
 25551-13-7 Trimethyl benzene
 91-20-3 Naphthalene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. July 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

AP2899
 HR# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: TOLUENE - COMMERCIAL

Number: 000000000000016114

Chemical characterization: C7 Aromatic Methylbenzol

CAS-No.: 108-88-3

Chemical Name: Toluene

Synonyms: Methyl benzene, Toluol

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

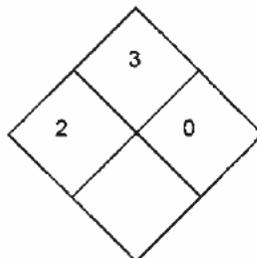
Signal Word

DANGER.

Hazards

Highly flammable. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. Ingestion and inhalation hazard. Aspiration hazard. Moderate eye irritant. Moderate skin irritant. Cardiac sensitization. Developmental toxin. Toxic to the nervous system. May effect hearing. Contains carcinogenic components.

NFPA®



HMIS®

Health	2
Flammability	3
Physical Hazard	0

Physical state

liquid

Color

Colorless.

Odor

Sweet aromatic.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Odor Threshold

AHA reports the odor threshold at 1.6 ppm for toluene. Patty's toxicology reports the odor threshold at 2.5 to 8.0 ppm, for toluene.

Potential health effects

Routes of exposure

Eye. Inhalation. Skin.

Acute effects

See component summary.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

Skin

May cause moderate skin irritation. Not expected to be a sensitizer.

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Eyes

Moderate eye irritant. Effects of eye irritation are reversible.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May lead to potentially fatal cardiac sensitization.

Chronic effects

See component summary.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Ethyl Benzene 100-41-4*

May affect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

3. COMPOSITION/INFORMATION ON INGREDIENTS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Toluene	108-88-3	203-625-9	95.0 <= 99.99
Benzene	71-43-2	200-753-7	0.0 <= 2.0
Ethyl Benzene	100-41-4	202-849-4	0.0 <= 0.5
p-Xylene	106-42-3	203-396-5	0.0 < 0.1
m-Xylene	108-38-3	203-576-3	0.0 < 0.1

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Immediately remove excess chemical and contaminated clothing; thoroughly wash contaminated skin with mild soap and water. If irritation persists after washing, seek medical attention. Thoroughly clean contaminated clothing before reuse; discard contaminated leather goods (gloves, shoes, belts, wallets, etc.).

Inhalation

Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

Thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persists, seek medical attention.

Ingestion

DO NOT induce vomiting. Give large quantities of water. Obtain emergency medical attention.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

4.4 °C (39.92 °F) closed cup

Autoignition temperature

498 °C (928.4 °F)

Lower explosion limit

1.3 vol%

Upper explosion limit



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Upper explosion limit
 8 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemicals, CO₂, or foam. LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear an approved positive pressure self-contained breathing apparatus and firefighter turnout gear.

Precautions for fire-fighting

Vapors may travel long distances along the ground before reaching a source of ignition and flashing back. Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined.

Hazardous combustion products

Carbon oxides (CO, CO₂)

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Eliminate all sources of ignition. Stop leak if you can do it without risk. Release can cause fire or explosion. Blanket with alcohol-resistant foam. Prevents spreading of vapors through sewers, ventilation systems and confined areas. Prevent entry into waterways, sewers, basements or confined areas. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Use clean non-sparking tools to collect absorbed material. Dike large spills and place materials in salvage containers.

7. HANDLING AND STORAGE

Handling

Do not handle near heat, sparks, or flame. Avoid contact with incompatible agents. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Do not enter storage area unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance.

Storage

Keep container tightly closed and properly labeled. Do not store near strong oxidizers. Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Skin

Use chemical resistant gloves appropriate to conditions of use. When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn.

Eyes

Use splash goggles when eye contact due to splashing or spraying liquid is possible. Safety glasses are the minimum requirements.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Take off contaminated clothing and wash before reuse. Shower after work using plenty of soap and water.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Toluene	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.
Benzene	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.
NIOSH	IDLH	500 ppm	None.	
Ethyl Benzene	US (ACGIH)	STEL	125 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	US (OSHA)	TWA	100 ppm 435 mg/m ³	None.
	NIOSH	IDLH	800 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

p-Xylene	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	NIOSH	IDLH	900 ppm	None.
m-Xylene	US (ACGIH)	STEL	150 ppm	None.
	US (ACGIH)	TWA	100 ppm	None.
	NIOSH	IDLH	900 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Colorless.

Odor: Sweet aromatic.

Odor Threshold: AIHA reports the odor threshold at 1.6 ppm for toluene. Patty's toxicology reports the odor threshold at 2.5 to 8.0 ppm, for toluene.

pH: Not applicable.

Boiling point/boiling range: 111 °C (231.8 °F)

Melting/freezing point: -95 °C (-139 °F)

Flash point: 4.4 °C (39.92 °F) closed cup

Autoignition temperature: 498 °C (928.4 °F)

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: 1.3 vol%

Upper explosion limit: 8 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: 22 mm Hg @ 20 °C (68 °F)

Evaporation rate: 2.24 (butyl acetate = 1)

Relative density: 0.866 @ 20 °C (68 °F) (Water = 1)

Relative vapor density: 3.1 (Air = 1.0)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Viscosity: 0.560 mPa.s @ 25 °C (77 °F)

Water solubility: slightly soluble

Partition coefficient: n-octanol/water: Log Pow = 2.69

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Avoid contact with strong oxidizers, excessive heat, sparks or open flame.

Materials to avoid

Does not react with water or common materials.

Hazardous decomposition products

Excessive heating and/or incomplete combustion may produce carbon monoxide, carbon dioxide and other harmful substances.

Hazardous polymerization

Will not occur.

Reactions with Air and Water

Does not react with air, water or other common materials.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

See components summary.

COMPONENT INFORMATION

- *Toluene* 108-88-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported; an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

• Benzene 71-43-2

Acute toxicity

<u>LC50 (vapor)</u>			
	rat	13,700 PPM	4 HOURS
	mouse	9980	8 HOURS
	rat	10000	7 HOURS

LD50 (Skin) rabbit > 8260 MG/KG BWT

Acute effects

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Irritation

Skin

Skin irritant.

Eyes

Severe eye irritant.

Sensitization

No evidence of skin or respiratory sensitization.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered bodyweight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic *in vivo*, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Ethyl Benzene* 100-41-4

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of \geq 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Carcinogenicity

these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *p-Xylene* 106-42-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	4740 PPM	4 HOURS
<u>LC50 (Inhl)</u>	mouse	3907	6 HOURS
<u>LD50 (Oral)</u>	rat	4,029 MG/KG	
<u>LD50 (Skin)</u>	rabbit	4,350 MG/KG	

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations. Exposure to high vapor concentrations may cause effects on hearing.

Ingestion

May be harmful if swallowed. Ingestion may cause effects on liver, spleen and kidneys. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). Possible cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Skin absorption hazard. Considered to be of low toxicity by the dermal route of exposure. However, dermal exposure to high concentrations may cause discomfort and irritation of the gastrointestinal tract; effects on lungs, liver and kidneys; and CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure). Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

May be irritating to the skin. Repeated contact with skin may cause cracking and/or fissuring.

Eyes

May cause eye irritation.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Hearing. Central nervous system. Liver. Kidneys. Cardiac sensitization.

Repeated dose toxicity

May be toxic following repeated exposure to high doses. No standard repeated inhalation exposure study was available. However, in limited scope studies, repeated inhalation exposure of rats to p-xylene caused ototoxicity at ≥ 900 ppm (3.91 mg/L) but not at 450 ppm (1.95 mg/L). Repeated inhalation exposures of laboratory animals to other xylene isomers and/or mixed xylenes caused reduced body weight/weight gain at ≥ 1000 ppm (4.35 mg/L), liver and CNS (behavioral) effects at ≥ 100 ppm (0.43 mg/L), and, in rats, ototoxicity at ≥ 250 ppm (1.09 mg/L). No treatment-related effects were seen in rats after oral exposure to p-xylene at 800 mg/kg bwt/day for 13 weeks. Short-term (10-14 days) repeated oral exposure of rats to p-xylene produced increases in liver weights and decreases in body weights and relative thymus weights at 2000 mg/kg bwt/day, and ototoxicity at 899 mg/kg bwt/day (the only concentration tested for ototoxicity). No ototoxicity was observed in guinea pigs exposed to p-xylene at this dose level. Oral exposure of rats to mixed xylenes at 500 mg/kg bwt/day for 103 weeks produced only slightly decreased body weight. Repeated oral exposure of mice to mixed xylenes produced a reduction in body weight in females at 2000 mg/kg bwt/day for 13 weeks, but no treatment-related effects were seen after exposure to 1000 mg/kg bwt/day for 103 weeks. The observed liver effects may be adaptive rather than adverse effects.



MATERIAL SAFETY DATA SHEET

MSDS No: BF167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Reproductive effects

This substance is not expected to be a reproductive toxicant. No damage to reproductive organs was noted in rats exposed by oral gavage to p-xylene at 800 mg/kg bwt/day for 13 weeks. Results for mixed xylenes in a one-generation reproductive toxicity study (rats, inhalation at 500 ppm/2.17 mg/L) and two dominant lethal studies (rats, i.p.; mice, s.c; 864 mg/kg bwt), and from evaluation of reproductive organs in repeated dose studies (male rats, inhalation, 1000 ppm [4.35 mg/L]; rats [1000 mg/kg bwt/day] and mice [2000 mg/kg bwt/day], oral) indicate that mixed xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at high inhalation or oral doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

May be toxic to the developing embryo and fetus. Inhalation exposure of pregnant rats to p-xylene was reported to produce decreases in fetal weight and increases in post implantation loss at ≥ 700 ppm 3.0 mg/L), and increases in skeletal variations, but not malformations, at 2000 ppm (8.7 mg/L) in the presence of maternal toxicity (decreased body weight gain and feed consumption, and increased relative liver weight). No effect on neurobehavior was noted in offspring of rat dams exposed to 800 and 1600 ppm (3.5 or 7.0 mg/L) prenatally. After oral gavage exposure, increased resorptions and cleft palate formation were reported in fetuses of mice exposed to p-xylene at ≥ 1935 mg/kg bwt/day, in the presence of maternal toxicity (unspecified). As mice under stress have been shown to be predisposed to produce offspring with cleft palate, the significance of this finding is uncertain.

Genetic Toxicity

Not expected to be genotoxic. p-Xylene produced negative results in assays for gene mutation in bacteria and induction of micronuclei in mouse bone marrow after intraperitoneal injection. Two positive responses have been reported for mixed xylenes, but the overall weight of evidence from a variety of in vitro and in vivo genotoxicity studies with xylenes indicates that they are not genotoxic.

Carcinogenicity

Available data for mixed xylenes indicate that the para-Xylene product is not likely to be carcinogenic to humans. Cancer data for mixed xylenes are used as surrogate data for this product. Oral exposure to mixed xylenes for 2 years did not produce tumors in rats or mice at doses up to 500 or 1000 mg/kg bwt/day, respectively. IARC concluded that xylenes are not classifiable as to their carcinogenicity to humans (Group 3).

- *m-Xylene* 108-38-3

Acute toxicity

LC50 (Inhl) rat 8000 PPM 4 HOURS

LD50 (Oral) rat 5000 MG/KG BW

Irritation

Skin

May be absorbed percutaneously, defatting and irritation of the skin may occur.

Eyes

Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Carcinogenicity

This material is listed by IARC as; "Not classifiable as a human carcinogen (Group 3) human evidence is inadequate: animal evidence inadequate."

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

See component summary.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Environmental fate and pathways

Other adverse effects

See component summary.

COMPONENT INFORMATION

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 55 mg/l

LC50 / 96 HOUR *Carassius auratus* 22.8 mg/l

LC50 / 96 HOUR *Pimephales promelas* 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY *Oncorhynchus* sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY *Daphnia magna*. 1.0 mg/l

NOEC / 7 DAY *Ceriodaphnia dubia* 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Benzene* 71-43-2

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No : RF167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 5.3 - 21.6 mg/l

LC50 / 96 HOUR Pimephales promelas 14.0 - 15.6 mg/l

LC50 / 96 HOUR Poecilia reticulata 28.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS Daphnia magna. 10 mg/l

EC50 / 48 HOUR Ceriodaphnia dubia 17.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR Selenastrum capricornutum 28 - 100 mg/l

Toxicity to microorganisms

IC50 / 24 HOURS Nitrosomonas sp. 13 mg/l

Chronic toxicity to fish

LOEC / 32 DAY Pimephales promelas 1.6 mg/l

Chronic toxicity to aquatic invertebrates

EC50 / 7 DAY Ceriodaphnia dubia 11.6 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for bioaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Ethyl Benzene* 100-41-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 4.2 mg/l

LC50 / 96 HOUR Menidia menidia 5.1 mg/l

LC50 / 96 HOUR Poecilia reticulata 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR Daphnia magna. 1.8 - 2.9 mg/l

EC50 / 48 HOUR Artemia salina 9.2 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *p-Xylene* 106-42-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS *Oncorhynchus mykiss* 2.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna*. 3.6 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Selenastrum capricornutum* 4.4 mg/l

Toxicity to microorganisms

NOEC / 3 HOURS Activated sludge 157 mg/l

Chronic toxicity to fish

NOEC / 56 d *Oncorhynchus mykiss* 1.3 mg/l

Chronic toxicity to aquatic invertebrates

NOEC / 21 d *Daphnia magna*. 1.57 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Environmental fate and pathways

Mobility

Behavior in environmental compartments: Some volatilization from water or soil is expected, with p-xylene initially partitioned mainly to soil and water

Persistence and degradability

Biodegradation: This material is expected to be readily biodegradable. Expected to be hydrolytically stable, but rapidly degraded following atmospheric release.

Bioaccumulation: Significant bioaccumulation is not expected. Fish BCF (Anguilla japonica) 23.6 after 10 days; BCF (Carassius auratus) 14.8.

- *m-Xylene* 108-38-3

Ecotoxicity

Acute Fish toxicity

LC50 / 24 HOUR goldfish 58 mg/l

Environmental fate and pathways

Expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Volatilization from dry soil surfaces is expected. Volatilization from moist soil surfaces is expected. It may adsorb onto soils or sediments.

Persistence and degradability

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

Contaminated product/s oil/water may be U.S. Resource Conservation and Recovery Act (RCRA)/U.S. Occupational Safety and Health Administration (OSHA) hazardous waste due to potentially low flash point. Comply with federal, state, or local regulations for disposal. Use registered transporters.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name	Toluene
Reportable quantity	TOLUENE BENZENE
ID No.	UN1294
Hazard class	3
Packing group	II

15. REGULATORY INFORMATION



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Japan	ENCS/ISHL
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIC

Contact product.safety@lyondellbasell.com for additional global inventory information.

If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.

SARA 302/304

Component	TPQ	RQ
Toluene		1000 lbs
Benzene		10 lbs
Ethyl Benzene		1000 lbs
p-Xylene		100 lbs
m-Xylene		1000 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

Component	Reporting Threshold
Toluene	1.0%
Benzene	0.1%
Ethyl Benzene	0.1%
p-Xylene	1.0%
m-Xylene	1.0%

State Reporting

Known to the State of California to cause cancer.

71-43-2	Benzene	(December 11, 2009)
100-41-4	Ethyl Benzene	

Known to the State of California to cause birth defects.

108-88-3	Toluene	(December 11, 2009)
71-43-2	Benzene	



MATERIAL SAFETY DATA SHEET

MSDS No.: BE167
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

TOLUENE - COMMERCIAL

Known to the State of California to cause reproductive toxicity in males.

71-43-2 Benzene (December 11, 2009)

Known to the State of California to cause reproductive toxicity in females.

108-88-3 Toluene (December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

108-88-3 Toluene
 71-43-2 Benzene
 100-41-4 Ethyl Benzene
 106-42-3 p-Xylene
 108-38-3 m-Xylene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

108-88-3 Toluene
 71-43-2 Benzene
 100-41-4 Ethyl Benzene
 106-42-3 p-Xylene
 108-38-3 m-Xylene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

108-88-3 Toluene
 71-43-2 Benzene
 100-41-4 Ethyl Benzene
 106-42-3 p-Xylene
 108-38-3 m-Xylene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Last revision: Logo change. November 3 2010

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.



MATERIAL SAFETY DATA SHEET

TOLUENE - COMMERCIAL

MSDS No.: BE167
Variant: U.S.A.-EN
Revision: 1.1
Validation Date: 11/05/2010

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

AP3583
 HFR# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: OP 400

Number: 00000000000016088

Internal ID: AP3583

Chemical characterization: C4-C11 Petroleum Hydrocarbons

CAS-No.: Mixture

Synonyms: OP-400 Feedstock, Olefins Plant 400 degrees (F) End-point Naphtha, Olefins Plant Naphtha Feedstock, Hydrodesulfurized (HDS) Naphthas, HDS Naphta or gasoline, C4-C11 Refinery Naphthas Mix

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

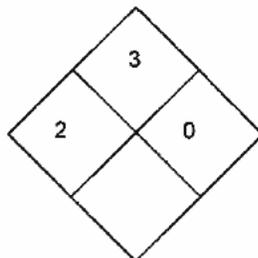
Signal Word

DANGER.

Hazards

Extremely flammable liquid. Harmful if inhaled or absorbed through the skin. Harmful or fatal if swallowed. CNS depressant. Aspiration hazard. Contains material which can cause cancer. Mutagenic Substance. Suspect reproductive hazard. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. Slipping hazard if spilled on hard smooth walking surface.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state

liquid

Color

colorless to light yellow



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Odor

Faint, mild hydrocarbon odor. Sweet aromatic.

Odor Threshold

1 - 7 ppm

Potential health effects

Routes of exposure

Eye. Inhalation. Skin.

- *Cyclopentane* 287-92-3

Aspiration hazard. May cause central nervous system depression.

- *Cyclohexane* 110-82-7

CNS depressant. Simple asphyxiant. May be irritating to the eyes, skin, and respiratory system.

- *Benzene* 71-43-2

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Methyl Cyclohexane* 108-87-2

Liquid, mist, or vapors can cause eye, skin and respiratory tract irritation. CNS depressant. Exposure to excess vapor may cause headache, fatigue, drowsiness and dizziness.

- *n-Hexane* 110-54-3

May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. May be irritating to the skin. High or repeated exposures can damage the peripheral nervous system, causing numbness, tingling, and/or muscle weakness in the hands or feet. The onset of health effects associated with n-hexane may be influenced by exposure to additional chemicals such as methyl isobutyl ketone and methyl ethyl ketone.

- *Toluene* 108-88-3

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Xylene* 1330-20-7

May be irritating to the eyes, skin, and respiratory system. Aspiration hazard. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Ethyl Benzene* 100-41-4

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *Cumene* 98-82-8

Slight eye irritant. Slight skin irritant. Aspiration hazard. CNS depressant.

- *Trimethyl benzene* 25551-13-7

CNS depressant. Aspiration hazard.

- *Ethyl Toluene* 25550-14-5

May be irritating to the skin.

- *Indene* 95-13-6

May cause drowsiness and dizziness. Aspiration into the lungs may cause chemical pneumonia.

- *Naphthalene* 91-20-3

May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus.

- *Butanes*

May produce symptoms of central nervous system depression including headache, dizziness, nausea, euphoria, loss of equilibrium, drowsiness, visual disturbances, fatigue, unconsciousness and respiratory arrest. Contact with liquid may cause frostbite.

Skin

May be absorbed through the skin and produce toxic effects such as CNS depression. May cause dermatitis by defatting the skin from prolonged or repeated contact.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Inhalation

High concentrations can displace oxygen and cause drowsiness, dizziness, unconsciousness and/or suffocation by asphyxiation.

Ingestion

Readily absorbed upon ingestion and may produce toxic effects similar to those resulting from inhalation exposure. Ingestion followed by vomiting could result in aspiration into the lungs of the more volatile components of this material which in turn could lead to life-threatening chemical pneumonia.

- *Cyclopentane 287-92-3*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin.

- *Cyclohexane 110-82-7*

No adverse chronic human health effects have been reported for this material.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Methyl Cyclohexane 108-87-2*

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

- *n-Hexane 110-54-3*

Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Prolonged and repeated exposure to vapors may cause damage to the CNS, lungs and kidneys. Suspect reproductive hazard.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Xylene 1330-20-7*

May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard.

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *Cumene 98-82-8*

This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans). Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. May cause kidney and/or lung damage.

- *Trimethyl benzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *Ethyl Toluene 25550-14-5*

Specific data not available.

- *Indene 95-13-6*

No known chronic health effects.

- *Naphthalene 91-20-3*

Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Potential Cancer Hazard, see section 11.

- *Butanes*

No known chronic health effects.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Naphtha (petroleum), hydrodesulfurized light	64742-73-0	265-178-6	50.0 <= 75.0
Naphtha (petroleum) hydrodesulfurized heavy	64742-82-1	265-185-4	25.0 <= 50.0
Cyclopentane	287-92-3	206-016-6	0.5 <= 1.5
Cyclohexane	110-82-7	203-806-2	1.0 <= 5.0
Benzene	71-43-2	200-753-7	0.1 <= 0.9
Methyl Cyclohexane	108-87-2	203-624-3	0.5 <= 1.5
n-Hexane	110-54-3	203-777-6	1.0 <= 3.0
Toluene	108-88-3	203-625-9	5.0 <= 15.0
Xylene	1330-20-7	215-535-7	10.0 <= 20.0
Ethyl Benzene	100-41-4	202-849-4	1.0 <= 5.0
Cumene	98-82-8	202-704-5	0.5 <= 2.0
Trimethyl benzene	25551-13-7	247-099-9	1.0 <= 10.0
Ethyl Toluene	25550-14-5	247-093-6	1.0 <= 3.0
Indene	95-13-6	202-393-6	0.1 <= 1.5
Naphthalene	91-20-3	202-049-5	0.5 <= 2.0
Butanes	Mixture	Mixture	1.0 <= 3.0

Typical composition

4. FIRST AID MEASURES

Skin

Remove contaminated clothing and shoes. Immediately flush the contact area with plenty of low pressure water to cool the skin. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.

Inhalation

Move to fresh air. If not breathing, give artificial respiration. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, give oxygen. Get immediate medical advice/ attention.

Eyes

Remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention. Do not use eye ointment unless directed to by a physician.

Ingestion



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Ingestion

Do NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. If victim is drowsy or unconscious, place on the left side with head down. Do not leave victim unattended. Obtain medical attention.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IA flammable liquid.

Flash point

-48 - -37 °C (-54.4 - -34.6 °F)

Autoignition temperature

229 - 275 °C (444.2 - 527 °F)

Lower explosion limit

0.9 vol% (% vol in air).

Upper explosion limit

8.5 vol% (% vol in air).

Extinguishing Media

Suitable extinguishing media

Extinguishing media - small fires Dry chemical Carbon dioxide (CO₂) Foam Water fog. Inert gas. Extinguishing media - large fires LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.

Precautions for fire-fighting

Fire Hazard Releases flammable vapors below normal ambient temperatures. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13). Use clean non-sparking tools to collect absorbed material.

7. HANDLING AND STORAGE



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Handling

Do not handle near heat, sparks, or flame. Avoid contact with incompatible agents. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Do not enter storage area unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded. Never siphon by mouth. Do not breathe vapor. Prevent contact with food, chewing, or smoking materials. Do not take internally. When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials. All sampling should be conducted in a manner which avoids skin contact and inhalation of vapors. Clean up any spilled material. Parts and equipment using or containing this material should be steam-cleaned if possible prior to all maintenance procedures. Empty containers retain some liquid and vapor residue and can be dangerous, so all hazard precautions must be observed when handling empties. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose containers to heat, flame, sparks, static electricity, or other sources of ignition. Empty drums should be completely drained, properly bunged and promptly disposed of or reconditioned. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Electrostatic charges may be generated as a result of flow or agitation.

Storage

Handle empty containers with care - residue may be combustible. Vapors may form explosive mixtures with air. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Store and transport in accordance with all applicable laws. Store containers in a cool, dry, ventilated, fire resistant area away from sources of ignition and incompatible materials. Refrigeration preferred. Refer to NFPA 77 and API RP-2003 for relevant consensus guidance.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of mists and/or vapors below the recommended exposure limits. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protective equipment

Inhalation

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Organic vapor or supplied air respirator may be appropriate. Respirator selection and use should comply with OSHA 29 CFR 1910.134 or ANSI Z88.2.

Skin

Wear long-sleeved fire-retardant garments (e.g., Nomex (R)) while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, boots, and additional facial protection.

Eyes

Safety glasses with side-shields. Use splash goggles when eye contact due to splashing or spraying liquid is possible.

Occupational Exposure Limits

Consult local authorities for acceptable exposure limits.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid colorless, to, light yellow

Odor: Faint, mild hydrocarbon odor. Sweet aromatic.

Odor Threshold: 1 - 7 ppm

pH: not applicable

Boiling point/boiling range: 0 - 274 °C (32 - 525.2 °F)

Melting/freezing point: -75 °C (-103 °F)

Flash point: -48 -- -37 °C (-54.4 -- -34.6 °F)

Autoignition temperature: 229 - 275 °C (444.2 - 527 °F)

Flammability: OSHA/NFPA Class IA flammable liquid.

Lower explosion limit: 0.9 vol% (% vol in air).

Upper explosion limit: 8.5 vol% (% vol in air).

Explosive properties: no data available

Oxidizing properties: no data available

Vapor pressure: ~ 11 - 62 kPa @ 37.8 °C (100.04 °F)

Evaporation rate: 8 - 10 (butyl acetate = 1)

Relative density: 0.67 - 0.73(Water = 1)

Viscosity: 0.5 - 1.5 mm²/s

Water solubility: Slightly soluble in cold water.

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable

Conditions to avoid

Keep away from heat and sources of ignition.

Materials to avoid

Oxidizers. Nitric acid

Hazardous decomposition products

Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

OP 400

11. TOXICOLOGICAL INFORMATION

Product information

COMPONENT INFORMATION

- *Naphtha (petroleum), hydrodesulfurized light* 64742-73-0

Acute toxicity

LD50 (Oral) rat >5000 MG/KG

LD50 (Skin) rabbit > 3160 MG/KG

- *Naphtha (petroleum) hydrodesulfurized heavy* 64742-82-1

Acute toxicity

LD50 (Oral) rat > 5000 MG/KG

LD50 (Skin) rabbit > 3160 MG/KG

- *Cyclopentane* 287-92-3

Acute toxicity

LC50 (Inhl) rat 106 GMM3

LD50 (Oral) rat 11,400 MG/KG

Acute effectsInhalation

Specific data not available.

Ingestion

Specific data not available.

Skin contact

Specific data not available.

IrritationSkin

Specific data not available.

Eyes

Specific data not available.

Target Organs

Skin. Central nervous system. Lung.

Repeated dose toxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Sensitive individuals may exhibit skin rash, wheezing, tightness of the chest, and difficulty breathing that may progress to a life-threatening inability to breathe.

Reproductive effects

No effects on reproductive organs were observed in a 90-day inhalation study with rats exposed to ~10,200 ppm (29.8 mg/L).

Genetic Toxicity

Cyclopentane was negative in the Ames Test and mouse lymphoma assay and in an in vivo micronucleus test, but induced chromosome aberrations in an in vitro mammalian cell assay.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

No data available.

- *Cyclohexane* 110-82-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	13.9 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	> 5000 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 2000 MG/KG	

Target Organs

Central nervous system effects.

Repeated dose toxicity

No known chronic health effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Benzene* 71-43-2

Acute toxicity

	rat	13,700 PPM	4 HOURS
	rabbit	> 8260 MG/KG BWT	

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered body weight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiological studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Methyl Cyclohexane* 108-87-2

Acute toxicity

LD50 (Oral) rat > 3,200 MG/KG

Irritation

Skin

May be irritating to the skin. Repeated or prolonged contact with skin may cause dermatitis.

Eyes

May cause eye irritation.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Hexane* 110-54-3

Acute toxicity

LC50 (Inhl) rat 48,000 PPM 4 HOURS

LD50 (Oral) rat 28,710 MG/KG

LD50 (Skin) rabbit 3000 MG/KG

Irritation

Eyes

Eye irritant.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Peripheral nervous system Testes.

Repeated dose toxicity

Rabbits exposed by inhalation to 3,000 ppm 8 hours/day for 8 days showed changes in the lungs, emphysema, necrosis of the bronchial epithelium, and atelectasis. Rats continuously exposed to 400 ppm developed anoxapathy, although intermittent exposure to 10,000 ppm 6 hours/day, 5 days/week for 13 weeks caused only mild paranodal axonal swelling. The offspring of rats and mice exposed orally or by inhalation to n-hexane during gestation showed depressed weight gain after birth. This agent also affects male and female reproductive capacity.

Reproductive effects



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Exposure to n-hexane may damage the developing fetus.

Developmental Toxicity

Causes productive and embryotoxic effects and is cytotoxic in mammalian and human test systems.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

Exposure of humans to 5,000 ppm n-hexane for 10 minutes causes marked vertigo; exposure to 1,500 ppm results in headache and slight nausea. In industrial settings, exposure to levels exceeding 1,000 ppm have been reported to cause mild symptoms of narcosis. Eye and upper respiratory tract irritation has been reported to occur in humans exposed to 880 ppm n-hexane for 15 minutes. Dermal contact with n-hexane results in immediate irritation characterized by erythema and hyperemia; exposed subjects developed blisters 5 hours following dermal exposure to n-hexane. The neuropathic toxicity of n-hexane in humans is well documented; cases of polyneuropathy have typically occurred in humans chronically exposed to levels of n-hexane ranging from 400 to 600 ppm, with occasional exposures up to 2,500 ppm. Distal symmetrical motor weakness is common in most cases; however, in severely affected individuals, motor weakness may extend to the pelvic and high musculature. Nerve biopsies in affected individuals show swelling of the nerve and thinning of the myelin sheath. Functional neurological disturbances usually progress for a few months after termination of exposure. Although recovery is expected to occur within a year, clinical polyneuropathy has been reported in some cases to remain after 2 years. Blurred vision, restricted visual field, and optic nerve atrophy has been reported to occur in association with n-hexane-induced polyneuropathy.

- *Toluene 108-88-3*

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight, increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

• Xylene 1330-20-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	5000 PPM	4 HOURS
	mouse	3907 MG/KG	6 HOURS
	rat	4550 PPM	4 HOURS
<u>LD50 (Oral)</u>	rat	4300 MG/KG	
<u>LD50 (Skin)</u>	rabbit	>1700 MG/KG	

Irritation

Skin

Moderate skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

This material is expected to be a mild eye irritant. Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Target Organs

Skin. Eye. central nervous system (CNS)

Repeated dose toxicity

Repeated inhalation exposures of rats to xylenes cause liver effects at 920 ppm (4.0 mg/L) and ototoxicity at \geq 800 ppm (3.48 mg/L). Repeated oral exposures to xylenes produce reductions in body weight in male rats at 500 mg/kg bwt/day, liver effects and hyaline droplet formation in male rats at \geq 150 mg/kg bwt/day, kidney effects in male and female rats at \geq 750 mg/kg bwt/day, and a reduction in bodyweight gain in male mice at \geq 250 mg/kg bwt/day. Repeated inhalation exposures of gerbils to \geq 160 ppm (0.70 mg/L) xylenes cause apparently irreversible CNS effects.

Reproductive effects

A reproductive toxicity study, two dominant lethal studies, and evaluation of reproductive organs in repeated dose studies indicate that xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at non-anesthetic doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

Results from animal studies demonstrate that xylenes may cause reduced fetal weight and delayed ossification, but not malformations, at inhalation dose levels causing no or only slight maternal toxicity (\geq 115 ppm or 0.5 mg/L). Slight neurobehavioral effects were noted in offspring of rats exposed to 500 ppm (2.2 mg/L) in the absence of maternal toxicity.

Carcinogenicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Not listed by IARC, NTP, OSHA or EPA.

- *Ethyl Benzene 100-41-4*

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of ≥ 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *Cumene* 98-82-8

Acute toxicity

<u>LC50 (Inhl)</u>	rat	39000 MG/M3	4 HOURS
<u>LD50 (Oral)</u>	rat	1400 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 3160 MG/KG	

Irritation

Skin

Slight skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

Slight eye irritant.

Sensitization

Not expected to be a sensitizer.

Target Organs

Central nervous system. Skin. Eye. Respiratory system. Nasal cavity. Kidney Liver Lungs

Reproductive effects

This substance is not expected to be a reproductive toxicant.

Genetic Toxicity

Negative for genotoxicity using both in vitro and in vivo tests.

Carcinogenicity

The NTP has found that Cumene causes increased incidences of combined benign and malign kidney tumors in male rats, and malignant lung tumors in mice of both sexes. This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans).

- *Trimethyl benzene* 25551-13-7

Acute toxicity

<u>LD50 (Oral)</u>	rat	8970 MG/KG
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Irritation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Skin

Skin irritant.

- *Ethyl Toluene* 25550-14-5

Acute toxicity

<u>LC50 (Inhl)</u>		50	2 HOURS
	mouse	54	4 HOURS

Irritation

Skin

Skin irritant.

Repeated dose toxicity

Repeated exposure may cause liver and kidney damage.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Indene* 95-13-6

Acute toxicity

<u>LC50 (Inhl)</u>	rat	14 GM/M3
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Carcinogenicity

Specific data not available.

- *Naphthalene* 91-20-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	>340 MG/M3	4 HOUR
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LD50 (Oral)

rat	490 MG/KG
mouse	533 MG/KG
guinea pig	1200 MG/KG

Irritation

Skin

Maybe irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Repeated inhalation or ingestion of naphthalene causes methemoglobine*

Developmental Toxicity

Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bwt/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bwt/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice).

Genetic Toxicity

Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bwt orally or 250 mg/kg bwt by intraperitoneal injection.

Carcinogenicity

The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

- *Butanes*

Irritation

Skin

None expected. Evaporating liquid may cause frost bite.

Eyes

None expected. Evaporating liquid may cause frost bite.

Target Organs

Skin. Eye. Central nervous system.

Repeated dose toxicity

No known chronic health effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

12. ECOLOGICAL INFORMATION

Product information

Product Summary

See componentsummary.

Ecotoxicity

See componentsummary.

Acute toxicity to aquatic invertebrates

LC50 / 96 HOURS Chaetogammarus marinus 2.6 mg/l

Environmental fate and pathways

no data available

COMPONENT INFORMATION

- *Naphtha (petroleum), hydrodesulfurized light* 64742-73-0

Ecotoxicity

Acute toxicity to aquatic invertebrates

/96 HOURS Chaetogammarus marinus 2.6 mg/l

Environmental fate and pathways

- *Naphtha (petroleum) hydrodesulfurized heavy* 64742-82-1

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Acute toxicity to aquatic invertebrates

LC50 / 96 HOURS Chaetogammarus marinus 2.6 mg/l

Environmental fate and pathways

- Cyclopentane 287-92-3

Ecotoxicity

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 10.5 mg/l

Environmental fate and pathways

Hydrolysis is not expected to be an important factor in the environmental fate process for this material. It is not expected to adsorb onto soils or sediments. Limited biodegradation. Expected to have high mobility in soils. This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

- Cyclohexane 110-82-7

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Pimephales promelas 4.53 mg/l (flow-through)

LC50 / 96 HOURS Lepomis macrochirus 34.72 mg/l

LC50 / 96 HOURS Poecilia reticulata 48.0 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 400 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS Scenedesmus subspicatus > 500 mg/l

Toxicity to microorganisms

EC50 / 5 min Photobacterium phosphoreum 85.5 mg/l

EC50 / 10 min Photobacterium phosphoreum 93 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. It is expected to be poorly adsorbed onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: The potential for volatilization from dry soil surfaces may exist. Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Biodegradation: This material is expected to be resistant to biodegradation.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Bioaccumulation: This material may bioaccumulate.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

/96 HOURS Oncorhynchus mykiss (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

/48 HOURS Daphnia magna. 10 mg/l

Toxicity to aquatic plants

/72 HOURS Pseudokirchneriella subcapitata (green algae) 32 mg/l

Toxicity to microorganisms

/24 HOURS Nitrosomonas sp. 13 mg/l

Chronic toxicity to fish

/32 DAY Pimephales promelas 1.6 mg/l

Chronic toxicity to aquatic invertebrates

/7 DAY Ceriodaphnia dubia 3 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Methyl Cyclohexane* 108-87-2

Ecotoxicity

This material may be harmful to aquatic species.

Acute Fish toxicity

LC50 /96 HOUR Golden shiner (notemigonus crysoleucas) 72 mg/l

Environmental fate and pathways

No Data Available.

- *n-Hexane* 110-54-3

Ecotoxicity

This material may be very toxic to aquatic species.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 4.14 mg/l

LC50 / 96 HOUR Pimephales promelas 2.5 mg/l

LC50 / 96 HOURS Lepomis macrochirus 4.12 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 3.87 mg/l

Environmental fate and pathways

Photolysis, hydrolysis or bioconcentration of n-hexane are not expected to be an important environmental fate processes. Biodegradation of n-hexane may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A Koc range of 1250 to 4100 indicates a low to slight mobility class in soil for n-hexane. In aquatic systems n-hexane may partition from the water column to organic matter contained in sediments and suspended materials. Rapid volatilization from environmental waters is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 55 mg/l

LC50 / 96 HOUR Carassius auratus 22.8 mg/l

LC50 / 96 HOUR Pimephales promelas 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR Daphnia magna. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY Daphnia magna. 1.0 mg/l

NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Xylene 1330-20-7*

Ecotoxicity

This material is classified as harmful to fish.

Acute Fish toxicity

LC50 /96 HOUR rainbow trout 13.5 mg/l

LC50 /24 HOUR goldfish 13 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Expected to have moderate mobility in soils. Volatilization from moist soil surfaces is expected. Volatilization from dry soil surfaces is expected.

Persistence and degradability

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Ethyl Benzene 100-41-4*

Ecotoxicity

Acute Fish toxicity

LC50 /96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 /96 HOUR *Menidia menidia* 5.1 mg/l

LC50 /96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 /48 HOUR *Daphnia magna* 1.8 - 2.9 mg/l

EC50 /48 HOUR *Artemia salina* 9.2 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Cumene* 98-82-8

Ecotoxicity

This material is toxic to fish. It may cause long term adverse effects in the aquatic environment.

Acute Fish toxicity

LC50 / 96 HOURS *Pimephales promelas* (fathead minnow) 6.04 - 6.61 mg/l

Summary: flow-through test

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 4.8 mg/l

Summary: flow-through test

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 2.7 mg/l

Summary: semi-static test

LC50 / 96 HOURS *Poecilia reticulata* (guppy) 5.1 mg/l

Summary: semi-static test

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna* (Water flea) 0.6 mg/l

EC50 / 48 HOURS *Daphnia magna* (Water flea) 7.9 - 14.1 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Toxicity to aquatic plants

EC50 / 72 HOURS *Pseudokirchneriella subcapitata* 2.6 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals. It may adsorb onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process. Volatilization from moist soil surfaces is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: This material is expected to be readily biodegradable.

Bioaccumulation: Bioconcentration factor (BCF) ~ 35 BCF ~ 35.0

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Ethyl Toluene* 25550-14-5

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Indene* 95-13-6

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Naphthalene* 91-20-3

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Acute Fish toxicity

LC50 / 96 HOURS rainbow trout. 26 mg/l
 Summary: Very toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 21.9 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: Naphthalene has a moderate tendency to bioaccumulate although fish and microorganisms readily metabolize it.

- *Butanes*

Ecotoxicity

No Data Available.

Environmental fate and pathways

No Data Available.

13. DISPOSAL CONSIDERATIONS

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) characteristics. Contaminated product, soil, water, container residues and spill cleanup materials may be hazardous wastes under applicable local, state or international regulations due to toxicity. Dispose of as hazardous waste in compliance with local and national regulations.

14. TRANSPORT INFORMATION

Proper shipping name Petroleum distillates, n.o.s. (XYLENE, TOLUENE)
Reportable quantity BENZENE
 NAPHTHALENE
ID No. UN1268
Hazard class 3
Packing group I

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

Canada	DSL
European Union	EINECS
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Naphthalene		100 lbs
Cyclohexane		1000 lbs
Cumene		5000 lbs
Benzene		10 lbs
Xylene		100 lbs
n-Hexane		5000 lbs
Toluene		1000 lbs
Ethyl Benzene		1000 lbs

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
Naphthalene	0.1%
Cyclohexane	1.0%
Cumene	1.0%
Benzene	0.1%
Xylene	1.0%
n-Hexane	1.0%
Toluene	1.0%
Ethyl Benzene	0.1%

State Reporting

Known to the State of California to cause cancer.

91-20-3	Naphthalene	(December 11, 2009)
98-82-8	Cumene	(June 14, 2010)
71-43-2	Benzene	(December 11, 2009)
100-41-4	Ethyl Benzene	

Known to the State of California to cause birth defects.

71-43-2	Benzene	(December 11, 2009)
108-88-3	Toluene	

Known to the State of California to cause reproductive toxicity in males.

71-43-2	Benzene	(December 11, 2009)
---------	---------	---------------------

Known to the State of California to cause reproductive toxicity in females.

108-88-3	Toluene	(December 11, 2009)
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This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

25550-14-5	Ethyl Toluene
25167-67-3	Butenes



MATERIAL SAFETY DATA SHEET

MSDS No.: BE169
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

OP 400

25551-13-7	Trimethyl benzene
91-20-3	Naphthalene
95-13-6	Indene
110-82-7	Cyclohexane
98-82-8	Cumene
71-43-2	Benzene
287-92-3	Cyclopentane
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
108-87-2	Methyl Cyclohexane
100-41-4	Ethyl Benzene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

25551-13-7	Trimethyl benzene
91-20-3	Naphthalene
95-13-6	Indene
110-82-7	Cyclohexane
98-82-8	Cumene
71-43-2	Benzene
287-92-3	Cyclopentane
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
108-87-2	Methyl Cyclohexane
100-41-4	Ethyl Benzene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

25167-67-3	Butenes
25551-13-7	Trimethyl benzene
91-20-3	Naphthalene
95-13-6	Indene
110-82-7	Cyclohexane
98-82-8	Cumene
71-43-2	Benzene
287-92-3	Cyclopentane
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
108-87-2	Methyl Cyclohexane
100-41-4	Ethyl Benzene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Revised Section(s): 1 2 11

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE169
Variant: U.S.A.-EN
Revision: 1.2
Validation Date: 05/20/2011

OP 400

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

COKER GAS OIL

AP3739
 MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

HFR# 1,1,1

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: COKER GAS OIL

Number: 000000000000016095

Internal ID: AP3739

CAS-No.: 64741-81-7

Chemical Name: Distillates (petroleum), heavy thermal cracked

Synonyms: CHGO, Delayed Coker Unit Heavy Gas Oil, Coker Fractionator Tower Sidestream, HVGO, Cracked Heavy Gas Oil, Heavy Gas Oil from a Thermocracker Unit, Thermal-cracked Heavy Gas Oil, Heavy Thermocracked Distillate, Feedstock to the 634 Hydrodesulfurization Unit, Coker Fractionator Stripper Tower Bottoms, Untreated FCCU Feedstock, Cracker Unit Feedstock, C15-C36 Petroleum Hydrocarbons

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

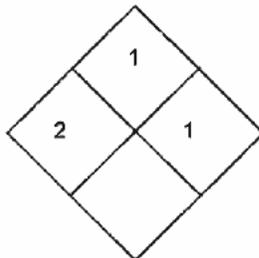
Signal Word

WARNING.

Hazards

May cause irritation of the skin. Contact with hot liquid may cause burns. Heavier than air, vapors may travel long distances along the ground before igniting and flash back to vapor source. Hydrogen sulfide (H₂S) and other hazardous vapors may evolve and collect in the headspace of storage tanks and other enclosed vessels. H₂S is an extremely flammable and a highly toxic gas. Contain 4-to-6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbazoles. May affect the unborn. Potential cancer hazard.

NFPA®



HMIS®

Health	*	1
Flammability		1
Physical Hazard		1

Physical state
 liquid



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

Color
 dark brown black

Odor
 characteristic

Odor Threshold
 No value available.

Potential health effects

Routes of exposure
 Skin. Eye. Inhalation.

Skin
 May be mildly irritating to the skin. Not a sensitizer.

Inhalation
 No significant signs or symptoms indicative of any health hazard are expected to occur as a result of inhalation exposure.

Eyes
 No significant signs or symptoms indicative of any adverse health hazard are expected to occur as a result of eye exposure.

Ingestion
 Slight ingestion hazard.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Distillates (petroleum), heavy thermal cracked	64741-81-7	265-082-4	100.0

Typical composition

4. FIRST AID MEASURES

General advice

May cause cancer. This substance may be genotoxic. May cause harm to the unborn child. Harmful by inhalation. Harmful: danger of serious damage to health by prolonged exposure in contact with skin. Inhalation of heated vapors or mists may cause central nervous system (CNS) effects including headache, drowsiness, dizziness, and blurred vision and possible cardiac sensitization.

Ingestion may cause CNS effects, discomfort and irritation of the gastrointestinal tract, nausea, vomiting, and diarrhea. May be irritating to the eyes. May be irritating to the skin. Repeated exposure may cause skin dryness or cracking. Very toxic by inhalation. H₂S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light). Always observe self-protection methods. Move out of dangerous area. Do not leave the victim unattended. Remove contaminated shoes and clothing. Get medical attention immediately. Show this material safety data sheet to the doctor in attendance.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

Skin

All contaminated clothing should be removed, and contaminated skin areas washed with lipophilic soap, or green soap, and water. DO NOT use gasoline, kerosene, solvents, or harsh abrasive skin cleaners. Do not wash with machine dishwashing or laundry detergents. Seek medical attention if tissue appears damaged or if pain or irritation persists. In the event of a high pressure injection injury, worker should obtain immediate medical assistance. Discard contaminated leather goods.

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Keep patient warm and at rest. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Eyes

In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not use eye ointment unless directed to by a physician. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person.

Notes to physician

Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IIIB combustible liquid.

Flash point

> 180 °C (> 356 °F)

Autoignition temperature

No Data Available.

Lower explosion limit

not determined

Upper explosion limit

not determined

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use water spray, dry chemical, foam, or carbon dioxide. Sand LARGE FIRES: Water spray Foam Water fog. Sand Carbon dioxide (CO₂) Dry chemical Apply water carefully to avoid frothing/steam explosion.

Unsuitable extinguishing media

Do not use a solid water stream as it may scatter and spread fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

provide limited protection.

Precautions for fire-fighting

This material will release vapors when heated above the flash point temperature that can ignite when exposed to a source of ignition. Vapors may travel long distances along the ground before reaching a source of ignition and flashing back. Move containers from fire area if you can do it without risk. Fight from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. Always stay away from the ends of tanks. Contents under pressure and can explode when exposed to heat or flames. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Burning liquid may float on water. Apply aqueous extinguishing media carefully to any molten/liquid material to prevent frothing/steam explosion. Prevent fire extinguishing water from contaminating surface water or the ground water system. Notify authorities immediately if liquid enters sewer/public waters. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

Hazardous combustion products

Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke). May also include hydrogen sulfide, sulfur oxides or sulfuric acid.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Contain/collect rapidly to minimize dispersion. Release causes immediate fire/explosion hazard. Evacuate/limit access. Eliminate all sources of ignition. If liquid is hot, let cool naturally. Notify fire and environmental authorities. Note: recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken. Use clean non-sparking tools to collect absorbed material. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. For large spills: Contain spill with dike to prevent entry into sewers or waterways. Water spray may reduce vapor; but may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. DO NOT use water jet. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place contaminated materials into appropriate containers for disposal. On water, contain/minimize dispersion/collect. Remove from surface water (e.g. by skimming or siphoning). The use of dispersants should be advised by an expert, and, if required, approved by local authorities.

If the product contaminates rivers and lakes or drains inform respective authorities.

7. HANDLING AND STORAGE

Handling

Use only with adequate ventilation and in closed systems. Ensure all equipment is electrically grounded before beginning transfer operations. Eliminate all sources of ignition. Liquid material is slippery-remove small leaks/spills from walking surface with solid absorbent. Odor is not an adequate warning of potentially hazardous ambient air concentrations. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Check atmosphere for explosiveness and oxygen deficiencies. (Subject to applicability): Concentration of hydrogen sulfide (H₂S) in tank headspaces may reach hazardous values, especially in case of prolonged storage. This situation is especially relevant for those operations which involve direct exposure to the vapors in the tank.

If sulfur compounds are suspected to be present in the product, check the atmosphere for hydrogen sulfide (H₂S) content. Do not handle near heat, sparks, or open flame. Use good housekeeping practices during use, storage, transfer, and handling. Electrostatic charges may be generated as a result of flow or agitation. Do not use compressed air for filling, discharging or handling. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. This liquid may accumulate static electricity even when transferred into properly grounded



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

Handling

containers. Always keep nozzle in contact with the container throughout the loading process. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Use only non-sparking tools. Avoid contact with incompatible agents. Handle empty containers with care; vapor/residue may be flammable. Ensure that all relevant regulations regarding explosive atmospheres, and handling and storage facilities of flammable products are followed.

Storage

Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Electrical installations / working materials must comply with the technological safety standards. Hydrogen sulfide (H₂S) and other hazardous vapors may evolve and collect in the headspace of storage tanks and other enclosed vessels. H₂S is an extremely flammable and a highly toxic gas. Store in original container. Store closed drums with bung in up position. Keep away from all ignition sources; segregate from incompatible materials. Keep containers tightly closed in a dry, cool, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers, transfer vessels, and equipment containing this material. Containers should be able to withstand pressures expected from warming or cooling during storage. Flammable materials should be stored in separate safety storage cabinet or room. Bonding and grounding measures may not be enough if nonconductive flammables are involved. Recommended materials: For containers, or container linings use mild steel, stainless steel. Unsuitable materials: Some synthetic materials may be unsuitable for container or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Engineering controls, preferably enclosed systems, should be used whenever feasible to maintain exposures below acceptable criteria. When such controls are not feasible, or sufficient to achieve full conformance, other engineering controls such as local exhaust ventilation should be used. Where engineering controls are not feasible use adequate local exhaust ventilation wherever mist, spray or vapor may be generated. Provide local exhaust or general room ventilation to minimize exposure to vapors. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1)

Personal protective equipment

Inhalation

Use an approved respirator, either air-supplied or air purifying (consult your company safety professional for guidance). The type of respiratory protection will depend upon whether the maximum exposure concentration is known. Consider the maximum period for wear. If exposure exceeds the standard limits, respiratory protection equipment which meets 29 U.S. Code of Federal Regulations (CFR) 1910.134 and is U.S. National Institute for Occupational Safety and Health (NIOSH) approved must be worn. Organic vapor or supplied air respirator may be appropriate. Respirator selection and use should comply with OSHA 29 CFR 1910.134 or ANSI Z88.2.

Skin

Impervious gloves Wear chemical resistant gloves such as: Neoprene, Nitrile, Vinyl Butyl Rubber Gloves, or PVC Avoid contact with skin. Skin should be washed after contact. Flame retardant protective clothing Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. Avoid contact with skin. Immediately remove all contaminated clothing. Use PPE that is chemical resistant to the product and prevents skin contact.

Eyes

Wear safety glasses. Where the opportunity for a splash or spray caused by high pressure or agitation of the material is possible, use a face shield and chemical goggles.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
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MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

Hydrogen sulfide	US (ACGIH)	STEL	15 ppm	None.
	US (ACGIH)	TWA	10 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	20 ppm	None.
	NIOSH	IDLH	100 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid dark brown, black

Odor: characteristic

Odor Threshold: No value available.

pH: Not applicable.

Boiling point/boiling range: > 150 - 750 °C (302 - 1,382 °F)

Melting/freezing point: < 30 °C (< 86 °F)

Flash point: > 180 °C (> 356 °F)

Autoignition temperature: No Data Available.

Flammability: OSHA/NFPA Class IIIB combustible liquid.

Lower explosion limit: not determined

Upper explosion limit: not determined

Explosive properties: Not applicable. (No chemical groups associated with explosive properties.)

Oxidizing properties: No Data Available.

Vapor pressure: 0.02 - 0.791 kPa @ 120 °C (248 °F) (MW 330 to 500) 0.063 - 0.861 kPa @ 150 °C (302 °F) (MW 350 to 420)

Evaporation rate: Not applicable.

Relative density: 0.8 - 1.2

Relative vapor density: 10 @ 21.1 °C (69.98 °F)(Air = 1.0)

Viscosity: > 20.5 mm²/s @ 40 °C (104 °F)

Water solubility: no data available

Partition coefficient: n-octanol/water: no data available

Other physico-chemical properties: No additional information available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Conditions to avoid

Heat, flames and sparks. Avoid static discharge or other sources of ignition. Electrostatic charges may be generated as a result of flow or agitation.

Materials to avoid

Strong acids and oxidizing agents

11. TOXICOLOGICAL INFORMATION

Product information

Acute toxicity

<u>LC50 (aerosol)</u>	rat	4.1 MG/L
<u>LD50 (Oral)</u>	rat	4,320 MG/KG
<u>LD50 (Skin)</u>	rabbit	> 2000 MK/KG

Acute effects

Inhalation

Predicted exposure concentration Stream expected to have a low order of acute inhalation toxicity based on toxicity information for streams having components in common with this stream.

Skin contact

Predicted exposure concentration Stream expected to have a low order of acute dermal toxicity based on toxicity information for streams having components in common with this stream.

Irritation

Skin

Stream expected to be no more than slightly irritating to the skin based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as a skin irritant

Eyes

Stream expected to be no more than transient, fully reversible irritating to the eye based on toxicity information for streams having components in common with this stream. These effects are not considered to warrant classification as an eye irritant.

Sensitization

Stream expected not to be a sensitizer based on toxicity information for streams having components in common with this stream.

Target Organs

Damages developing fetus.

Repeated dose toxicity

May cause damage to organs through prolonged or repeated exposure. Stream expected to be toxic to target organs with



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-BN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

repeated exposure based on toxicity information for streams having components in common with this stream. Results of repeated exposure toxicity testing indicate alterations in serum cholesterol and blood urea nitrogen at high dermal doses accompanied by red blood cell, platelet, liver, and thymus effects at lower exposure levels.

Reproductive effects

Stream expected not to be toxic to reproduction based on toxicity information for streams having components in common with this stream.

Developmental Toxicity

Suspected of damaging the unborn child. Stream expected to be toxic to development based on toxicity information for streams having components in common with this stream. Results of developmental toxicity testing indicate alterations in fetal and pup development, which sometimes occurred in the presence of maternal toxicity.

Genetic Toxicity

Not mutagenic. Stream expected to be not mutagenic based on toxicity information for streams having components in common with this stream.

Carcinogenicity

Stream expected to be carcinogenic based on toxicity information for streams having components in common with this stream. Results obtained from the modified Ames test, from mouse skin painting tests and initiation/promotion assay along with chemical (PAH) analysis indicate that Heavy Fuel Oil streams are carcinogenic.

COMPONENT INFORMATION

- *Distillates (petroleum), heavy thermal cracked 64741-81-7*

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Acute Fish toxicity

LL50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 79 mg/l

Acute toxicity to aquatic invertebrates

static test / 48 HOURS *Daphnia magna* (Water flea) 2 mg/l

Toxicity to aquatic plants

EL50 / 72 HOURS 0.75 mg/l

Toxicity to microorganisms

LL50 / 0.72 HOURS *Tetrahymena pyriformis* (ciliated protozoa) > 1,000 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Chronic toxicity to fish

NOEC / 0.1 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

Chronic toxicity to aquatic invertebrates

NOEL / 0.27 mg/l

Summary: Based on Quantitative structure-activity relationship (QSAR) estimation.

Environmental fate and pathways

No additional information available.

Mobility

Predicted distribution to environmental compartments: Predicted distribution to environmental compartments Partitioning mainly to Soil

Persistence and degradability

Biodegradation: Not expected to be hydrolytically unstable. Not expected to be biodegradable.

Bioaccumulation: Consideration of representative hydrocarbon structures indicated none are likely to be highly bioaccumulative.

COMPONENT INFORMATION

- *Distillates (petroleum), heavy thermal cracked 64741-81-7*

Ecotoxicity

See Product Summary

Acute Fish toxicity

LC50 / 96 HOURS Zebra Fish. 48 mg/l

Environmental fate and pathways

See product summary.

Other adverse effects

See Product Summary

13. DISPOSAL CONSIDERATIONS

Dispose of as hazardous waste in compliance with local and national regulations. The product should not be allowed to enter drains, water courses or the soil. Proper grounding procedures to avoid static electricity should be followed. Can be incinerated, when in compliance with local regulations. Contaminated product, soil or water should be considered dangerous due to potential evolution of flammable vapor.

14. TRANSPORT INFORMATION

Proper shipping name Cracked Gas Oil, not regulated



MATERIAL SAFETY DATA SHEET

MSDS No.: BE93
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 07/05/2011

COKER GAS OIL

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	ACS
Canada	DSL
China	IECS
European Union	EINECS
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

Component	TPQ	RQ
Hydrogen sulfide	500lbs	100 lbs

SARA 313

This product contains no known chemicals regulated under SARA 313.

State Reporting

This product contains no known chemicals regulated by California's Proposition 65.

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

7783-06-4 Hydrogen sulfide

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

7783-06-4 Hydrogen sulfide

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

7783-06-4 Hydrogen sulfide

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Conversion to SAP template. June 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE93
Variant: U.S.A.-EN
Revision: 1.0
Validation Date: 07/05/2011

COKER GAS OIL

Disclaimer

Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

AP3807
 HER# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: REFORMER FEED UNFINISHED

Number: 00000000000016091

Internal ID: AP3807

Chemical characterization: C6-C12 Petroleum Hydrocarbons

CAS-No.: 68606-11-1

Synonyms: Naphtha from Crude Petroleum Oil, Untreated or Unrefined Heavy Naphtha or Gasoline, Topping Splitter Naphtha, Topper Gasoline, Topping Plant Heavy Straight-run Naphtha, Topping Plant Straight-run Gasoline (Petroleum)

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 productsafety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS as defined by the OSHA Hazard Communication Standard, 29CFR, 1910.1200.

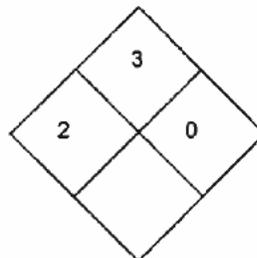
Signal Word

DANGER.

Hazards

Extremely flammable liquid. Harmful if inhaled or absorbed through the skin. Harmful or fatal if swallowed. CNS depressant. Aspiration hazard Contains material which can cause cancer. Mutagenic Substance. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. Slipping hazard if spilled on hard smooth walking surface.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state

liquid

Color

colorless to light yellow



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Odor

Aromatic or gasoline-like odor.

Odor Threshold

No value available.

Potential health effects

Routes of exposure

Inhalation Skin Absorption Eyes

- *Methylcyclopentane* 96-37-7

This product may cause eye, skin, and respiratory tract irritation. High concentrations may cause central nervous system (CNS) depression. Ingestion would likely cause gastrointestinal tract irritation.

- *n-Hexane* 110-54-3

May cause irritation to the eyes, nausea, vertigo, bronchial and central nervous system effects. This material presents an acute aspiration hazard. May be irritating to the skin. High or repeated exposures can damage the peripheral nervous system, causing numbness, tingling, and/or muscle weakness in the hands or feet. The onset of health effects associated with n-hexane may be influenced by exposure to additional chemicals such as methyl isobutyl ketone and methyl ethyl ketone.

- *Benzene* 71-43-2

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Methyl Cyclohexane* 108-87-2

Liquid, mist, or vapors can cause eye, skin and respiratory tract irritation. CNS depressant. Exposure to excess vapor may cause headache, fatigue, drowsiness and dizziness.

- *Toluene* 108-88-3

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Xylene* 1330-20-7

May be irritating to the eyes, skin, and respiratory system. Aspiration hazard. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Ethyl Benzene* 100-41-4

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *Cumene* 98-82-8

Slight eye irritant. Slight skin irritant. Aspiration hazard. CNS depressant.

- *Trimethyl benzene* 25551-13-7

CNS depressant. Aspiration hazard.

- *Ethyl Toluene* 25550-14-5

May be irritating to the skin.

- *Naphthalene* 91-20-3

May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus.

Skin

May be absorbed through the skin and produce toxic effects such as CNS depression. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Inhalation

High concentrations can displace oxygen and cause drowsiness, dizziness, unconsciousness and/or suffocation by asphyxiation.

Ingestion



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Ingestion

Readily absorbed upon ingestion and may produce toxic effects similar to those resulting from inhalation exposure. Ingestion followed by vomiting could result in aspiration into the lungs of the more volatile components of this material which in turn could lead to life-threatening chemical pneumonia.

- *Methylcyclopentane 96-37-7*

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

- *n-Hexane 110-54-3*

Damage to nerves in hands or feet may occur from prolonged inhalation of n-hexane concentrations of 60 to 240 ppm. Repeated exposure to air concentrations of 500 ppm n-hexane can produce progressively worsening damage to the peripheral nerves. Prolonged and repeated exposure to vapors may cause damage to the CNS, lungs and kidneys. Suspect reproductive hazard.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Methyl Cyclohexane 108-87-2*

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Xylene 1330-20-7*

May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard.

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *Cumene 98-82-8*

This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans). Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. May cause kidney and/or lung damage.

- *Trimethyl benzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *Ethyl Toluene 25550-14-5*

Specific data not available.

- *Naphthalene 91-20-3*

Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Potential Cancer Hazard, see section 11.

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Gasoline, Straight Run	68606-11-1	271-727-0	100.0
Methylcyclopentane	96-37-7	202-503-2	1.0 <= 3.0
n-Hexane	110-54-3	203-777-6	1.0 <= 5.0
Benzene	71-43-2	200-753-7	1.0 <= 3.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Methyl Cyclohexane	108-87-2	203-624-3	1.0	<= 5.0
Toluene	108-88-3	203-625-9	1.0	<= 10.0
Xylene	1330-20-7	215-535-7	1.0	<= 10.0
Ethyl Benzene	100-41-4	202-849-4	0.2	<= 3.0
Cumene	98-82-8	202-704-5	0.1	<= 3.0
Trimethyl benzene	25551-13-7	247-099-9	1.0	<= 5.0
Ethyl Toluene	25550-14-5	247-093-6	1.0	<= 5.0
Naphthalene	91-20-3	202-049-5	0.1	<= 0.9

Typical composition

4. FIRST AID MEASURES

Skin

Remove contaminated clothing and shoes. Immediately flush the contact area with plenty of low pressure water to cool the skin. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.

Inhalation

Move to fresh air. If not breathing, give artificial respiration. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, give oxygen. Get immediate medical advice/ attention.

Eyes

Remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention. Do not use eye ointment unless directed to by a physician.

Ingestion

Do NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. If victim is drowsy or unconscious, place on the left side with head down. Do not leave victim unattended. Obtain medical attention.

Notes to physician

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

-9 - -6 °C (15.8 - 21.2 °F) closed cup

Autoignition temperature

~ 232 °C (449.6 °F)



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Lower explosion limit
 ~ 0.9 vol%

Upper explosion limit
 ~ 7.0 vol%

Extinguishing Media

Suitable extinguishing media

Extinguishing media - small fires Drychemical Carbon dioxide (CO₂) Foam Water fog. Inert gas. Extinguishing media - large fires **LARGE FIRE:** Use water spray, water fog or foam. **DO NOT** use straight streams

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.

Precautions for fire-fighting

Fire Hazard Releases flammable vapors below normal ambient temperatures. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Flammable vapors may be heavier than air and travel long distances along the ground before igniting and flashing back to vapor source. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13). Use clean non-sparking tools to collect absorbed material.

7. HANDLING AND STORAGE

Handling

Do not handle near heat, sparks, or flame. Avoid contact with incompatible agents. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Do not enter storage area unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded. Never siphon by mouth. Do not breathe vapor. Prevent contact with food, chewing, or smoking materials. **Do not take internally.** When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials. All sampling should be conducted in a manner which avoids skin contact and inhalation of vapors. Clean up any spilled material. Parts and equipment using or containing this material should be steam-cleaned if possible prior to all maintenance procedures. Empty containers retain some liquid and vapor residue and can be dangerous, so all hazard precautions must be observed when handling empties. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose containers to heat, flame, sparks, static electricity, or other sources of ignition. Empty drums should be completely drained, properly bunged and promptly disposed of or reconditioned. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Electrostatic charges may be generated as a result of flow or agitation.

Storage

Handle empty containers with care - residue may be combustible. Vapors may form explosive mixtures with air. Vapor



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-BN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Storage

space above stored liquid may be flammable/explosive unless blanketed with inert gas. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water. Store and transport in accordance with all applicable laws. Store containers in a cool, dry, ventilated, fire resistant area away from sources of ignition and incompatible materials. Refrigeration preferred. Refer to NFPA77 and API RP-2003 for relevant consensus guidance.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of mists and/or vapors below the recommended exposure limits. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protective equipment

Inhalation

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Organic vapor or supplied air respirator may be appropriate. Respirator selection and use should comply with OSHA 29 CFR 1910.134 or ANSI Z88.2.

Skin

Wear long-sleeved fire-retardant garments (e.g., Nomex (R)) while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, boots, and additional facial protection.

Eyes

Safety glasses with side-shields. Use splash goggles when eye contact due to splashing or spraying liquid is possible.

Occupational Exposure Limits

Consult local authorities for acceptable exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid colorless, to, light yellow

Odor: Aromatic or gasoline-like odor.

Odor Threshold: No value available.

pH: Not applicable.

Boiling point/boiling range: 80 - 235 °C (176 - 455 °F)

Melting/freezing point: < -46 °C (< -50.8 °F)

Flash point: -9 - -6 °C (15.8 - 21.2 °F) closed cup



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Auto ignition temperature: ~ 232 °C (449.6 °F)

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: ~ 0.9 vol%

Upper explosion limit: ~ 7.0 vol%

Explosive properties: no data available

Oxidizing properties: no data available

Vapor pressure: 13.8 - 15.2 kPa @ 38 °C (100.4 °F)

Evaporation rate: 0.35 - 2.0 (butyl acetate = 1)

Relative density: 0.83 - 0.85(Water = 1)

Relative vapor density: 3.1 - 3.5 (Air = 1.0)

Viscosity: 1 - 3 mm²/s

Water solubility: slightly soluble

Partition coefficient: n-octanol/water: Specific data not available.

Other physico-chemical properties: No information available.

10. STABILITY AND REACTIVITY

Chemical stability

Stable

Conditions to avoid

Keep away from heat and sources of ignition.

Materials to avoid

Oxidizers. Nitric acid

Hazardous decomposition products

Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

11. TOXICOLOGICAL INFORMATION

Product Information

Product Summary

No toxicology information is available.

COMPONENT INFORMATION



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

- *Gasoline, Straight Run* 68606-11-1

Other information

No data available.

- *Methylcyclopentane* 96-37-7

Target Organs

Skin. Eye. Respiratory system. Nervous system.

Repeated dose toxicity

Repeated exposure can cause peripheral nerve damage and defatting of the skin.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Hexane* 110-54-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	48,000 PPM	4 HOURS
<u>LD50 (Oral)</u>	rat	28,710 MG/KG	
<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	

Irritation

Eyes

Eye irritant.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Peripheral nervous system Testes.

Repeated dose toxicity

Rabbits exposed by inhalation to 3,000 ppm 8 hours/day for 8 days showed changes in the lungs, emphysema, necrosis of the bronchial epithelium, and atelectasis. Rats continuously exposed to 400 ppm developed anoxapathy, although intermittent exposure to 10,000 ppm 6 hours/day, 5 days/week for 13 weeks caused only mild paranodal axonal swelling. The offspring of rats and mice exposed orally or by inhalation to n-hexane during gestation showed depressed weight gain after birth. This agent also affects male and female reproductive capacity.

Reproductive effects

Exposure to n-hexane may damage the developing fetus.

Developmental Toxicity

Causes productive and embryotoxic effects and is cytotoxic in mammalian and human test systems.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

Exposure of humans to 5,000 ppm n-hexane for 10 minutes causes marked vertigo; exposure to 1,500 ppm results in headache and slight nausea. In industrial settings, exposure to levels exceeding 1,000 ppm have been reported to cause mild symptoms of narcosis. Eye and upper respiratory tract irritation has been reported to occur in humans exposed to 880 ppm n-hexane for 15 minutes. Dermal contact with n-hexane results in immediate irritation characterized by erythema and hyperemia; exposed subjects developed blisters 5 hours following dermal exposure to n-hexane. The neuropathic toxicity of n-n-hexane in humans is well documented; cases of polyneuropathy have typically occurred in humans chronically exposed to levels of n-hexane ranging from 400 to 600 ppm, with occasional exposures up to 2,500 ppm. Distal symmetrical motor weakness is common in most cases; however, in severely affected individuals, motor weakness may extend to the pelvic and high musculature. Nerve biopsies in affected individuals show swelling of the nerve and thinning of the myelin sheath. Functional neurological disturbances usually progress for a few months after termination of exposure. Although recovery is expected to occur within a year, clinical polyneuropathy has been reported in some cases to remain after 2 years. Blurred vision, restricted visual field, and optic nerve atrophy has been reported to occur in association with n-hexane-induced polyneuropathy.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

- *Benzene* 71-43-2

Acute toxicity

rat	13,700 PPM	4 HOURS
rabbit	> 8260 MG/KG BWT	

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered bodyweight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Methyl Cyclohexane* 108-87-2

Acute toxicity

<u>LD50 (Oral)</u>	rat	> 3,200 MG/KG
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Irritation

Skin

May be irritating to the skin. Repeated or prolonged contact with skin may cause dermatitis.

Eyes

May cause eye irritation.

Target Organs



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Skin. Eye. Respiratory system. Central nervous system effects.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA

- *Toluene* 108-88-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *Xylene* 1330-20-7

Acute toxicity

<u>LC50 (Inhl)</u>	rat	5000 PPM	4 HOURS
	mouse	3907 MG/KG	6 HOURS
	rat	4550 PPM	4 HOURS

LD50 (Oral) rat 4300 MG/KG

LD50 (Skin) rabbit >1700 MG/KG

Irritation

Skin

Moderate skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

This material is expected to be a mild eye irritant. Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Target Organs

Skin. Eye. central nervous system (CNS)

Repeated dose toxicity

Repeated inhalation exposures of rats to xylenes cause liver effects at 920 ppm (4.0 mg/L) and ototoxicity at \geq 800 ppm (3.48 mg/L). Repeated oral exposures to xylenes produce reductions in body weight in male rats at 500 mg/kg bwt/day; liver effects and hyaline droplet formation in male rats at \geq 150 mg/kg bwt/day; kidney effects in male and female rats at \geq 750 mg/kg bwt/day; and a reduction in bodyweight gain in male mice at \geq 250 mg/kg bwt/day. Repeated inhalation exposures of gerbils to \geq 160 ppm (0.70 mg/L) xylenes cause apparently irreversible CNS effects.

Reproductive effects

A reproductive toxicity study, two dominant lethal studies, and evaluation of reproductive organs in repeated dose studies indicate that xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at non-anesthetic doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

Results from animal studies demonstrate that xylenes may cause reduced fetal weight and delayed ossification, but not malformations, at inhalation dose levels causing no or only slight maternal toxicity (\geq 115 ppm or 0.5 mg/L). Slight neurobehavioral effects were noted in offspring of rats exposed to 500 ppm (2.2 mg/L) in the absence of maternal toxicity.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Ethyl Benzene* 100-41-4

Acute toxicity

LC50 (vapor) rat 4000 PPM

LD50 (Oral) rat 3500 - 4700 MG/KG BWT

LD50 (Skin) rabbit > 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of \geq 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day. Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations. An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK⁺/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *Cumene* 98-82-8

Acute toxicity

<u>LC50 (Inhl)</u>	rat	39000 MG/M3	4 HOURS
<u>LD50 (Oral)</u>	rat	1400 MG/KG	
<u>LD50 (Skin)</u>	rabbit	> 3160 MG/KG	

Irritation

Skin

Slight skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

Slight eye irritant.

Sensitization

Not expected to be a sensitizer.

Target Organs

Central nervous system. Skin. Eye. Respiratory system. Nasal cavity. Kidney Liver Lungs

Reproductive effects

This substance is not expected to be a reproductive toxicant.

Genetic Toxicity

Negative for genotoxicity using both in vitro and in vivo tests.

Carcinogenicity

The NTP has found that Cumene causes increased incidences of combined benign and malign kidney tumors in male rats, and malignant lung tumors in mice of both sexes. This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans).

- *Trimethyl benzene* 25551-13-7

Acute toxicity

<u>LD50 (Oral)</u>	rat	8970 MG/KG	
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Irritation

Skin

Skin irritant.

- *Ethyl Toluene* 25550-14-5

Acute toxicity

<u>LC50 (Inhl)</u>		50	2 HOURS
	mouse	54	4 HOURS

Irritation

Skin

Skin irritant.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Repeated dose toxicity

Repeated exposure may cause liver and kidney damage.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Naphthalene* 91-20-3

Acute toxicity

LC50 (Inhl) rat >340 MG/M3 4 HOUR

LD50 (Oral) rat 490 MG/KG
 mouse 533 MG/KG
 guinea pig 1200 MG/KG

Irritation

Skin

May be irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Repeated inhalation or ingestion of naphthalene causes methemoglobinemia*

Developmental Toxicity

Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bwt/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bwt/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice).

Genetic Toxicity

Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bwt orally or 250 mg/kg bwt by intraperitoneal injection.

Carcinogenicity

The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

Toxicity to aquatic plants

EC50 / 72 HOURS *Pseudokirchneriella subcapitata* 4,700 mg/l

Environmental fate and pathways

no data available

COMPONENT INFORMATION



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-BN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

- *Gasoline, Straight Run* 68606-11-1

Ecotoxicity

No Data Available.

Environmental fate and pathways

No Data Available.

- *Methylcyclopentane* 96-37-7

Ecotoxicity

No Data Available.

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Volatilization from dry soil surfaces is expected. Volatilization from moist soil surfaces is expected. The estimated BCF value suggests that this material will bioconcentrate in aquatic organisms.

Persistence and degradability

Stability in soil: This material is expected to have slight mobility in soil.

Biodegradation: No relevant studies identified.

Bioaccumulation: Bioconcentration factor (BCF) ~ 2.5 (estimated) Estimated BCF = 2.5

- *n-Hexane* 110-54-3

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.14 mg/l

LC50 / 96 HOUR *Pimephales promelas* 2.5 mg/l

LC50 / 96 HOURS *Lepomis macrochirus* 4.12 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *waterflea*. 3.87 mg/l

Environmental fate and pathways

Photolysis, hydrolysis or bioconcentration of n-hexane are not expected to be an important environmental fate processes. Biodegradation of n-hexane may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A Koc range of 1250 to 4100 indicates a low to slight mobility class in soil for n-hexane. In aquatic systems n-hexane may partition from the water column to organic matter contained in sediments and suspended materials. Rapid volatilization from environmental waters is expected.

Persistence and degradability



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-BN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: Biodegradation may occur in soil and water, however, volatilization and adsorption are expected to be far more important fate processes.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

/96 HOURS *Oncorhynchus mykiss* (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

/48 HOURS *Daphnia magna*. 10 mg/l

Toxicity to aquatic plants

/72 HOURS *Pseudokirchneriella subcapitata* (green algae) 32 mg/l

Toxicity to microorganisms

/24 HOURS *Nitrosomonas* sp. 13 mg/l

Chronic toxicity to fish

/32 DAY *Pimephales promelas* 1.6 mg/l

Chronic toxicity to aquatic invertebrates

/7 DAY *Ceriodaphnia dubia* 3 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for bioaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Methyl Cyclohexane* 108-87-2

Ecotoxicity

This material may be harmful to aquatic species.

Acute Fish toxicity

LC50 /96 HOUR Golden shiner (*notemigonus crysoleucas*) 72 mg/l

Environmental fate and pathways

No Data Available.

- *Toluene* 108-88-3



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 55 mg/l

LC50 / 96 HOUR Carassius auratus 22.8 mg/l

LC50 / 96 HOUR Pimephales promelas 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR Daphnia magna. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY Daphnia magna. 1.0 mg/l

NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Xylene* 1330-20-7

Ecotoxicity

This material is classified as harmful to fish.

Acute Fish toxicity

LC50 / 96 HOUR rainbow trout. 13.5 mg/l

LC50 / 24 HOUR goldfish 13 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Expected to have moderate mobility in soils. Volatilization from moist soil surfaces is expected. Volatilization from dry soil surfaces is expected.

Persistence and degradability



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-BN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Ethyl Benzene* 100-41-4

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 / 96 HOUR *Menidia menidia* 5.1 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

- *Cumene* 98-82-8

Ecotoxicity

This material is toxic to fish. It may cause long term adverse effects in the aquatic environment.

Acute Fish toxicity

LC50 / 96 HOURS *Pimephales promelas* (fathead minnow) 6.04 - 6.61 mg/l

Summary: flow-through test

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 4.8 mg/l

Summary: flow-through test

LC50 / 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 2.7 mg/l

Summary: semi-static test

LC50 / 96 HOURS *Poecilia reticulata* (guppy) 5.1 mg/l

Summary: semi-static test

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS *Daphnia magna* (Water flea) 0.6 mg/l

EC50 / 48 HOURS *Daphnia magna* (Water flea) 7.9 - 14.1 mg/l

Toxicity to aquatic plants

EC50 / 72 HOURS *Pseudokirchneriella subcapitata* 2.6 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals. It may adsorb onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process. Volatilization from moist soil surfaces is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: This material is expected to be readily biodegradable.

Bioaccumulation: Bioconcentration factor (BCF) ~ 35 BCF ~ 35.0

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Ethyl Toluene* 25550-14-5

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

No data available.

Environmental fate and pathways

No data available.

- *Naphthalene 91-20-3*

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS rainbow trout. 26 mg/l

Summary: Very toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 21.9 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: Naphthalene has a moderate tendency to bioaccumulate although fish and microorganisms readily metabolize it.

13. DISPOSAL CONSIDERATIONS

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) characteristics. Contaminated product, soil, water, container residues and spill cleanup materials may be hazardous wastes under applicable local, state or international regulations due to toxicity. Dispose of as hazardous waste in compliance with local and national regulations.

14. TRANSPORT INFORMATION

Proper shipping name Petroleum distillates, n.o.s. (XYLENE)

Reportable quantity BENZENE
NAPHTHALENE

ID No. UN1268

Hazard class 3

Packing group II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Canada	DSL
China	IECS
European Union	EINECS
Philippines	PICCS
United States of America	TSCA

Contact product.safety@lyondellbasell.com for additional global inventory information.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Naphthalene		100 lbs
Cumene		5000 lbs
Benzene		10 lbs
Xylene		100 lbs
n-Hexane		5000 lbs
Toluene		1000 lbs
Ethyl Benzene		1000 lbs

SARA 313

<u>Component</u>	<u>Reporting Threshold</u>
Naphthalene	0.1%
Cumene	1.0%
Benzene	0.1%
Xylene	1.0%
n-Hexane	1.0%
Toluene	1.0%
Ethyl Benzene	0.1%

State Reporting

Known to the State of California to cause cancer.

91-20-3	Naphthalene	(December 11, 2009)
98-82-8	Cumene	(June 14, 2010)
71-43-2	Benzene	(December 11, 2009)
100-41-4	Ethyl Benzene	

Known to the State of California to cause birth defects.

71-43-2	Benzene	(December 11, 2009)
108-88-3	Toluene	

Known to the State of California to cause reproductive toxicity in males.

71-43-2	Benzene	(December 11, 2009)
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Known to the State of California to cause reproductive toxicity in females.

108-88-3	Toluene	(December 11, 2009)
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This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

25550-14-5	Ethyl Toluene
25551-13-7	Trimethyl benzene
91-20-3	Naphthalene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE174
 Variant: U.S.A.-EN
 Revision: 1.2
 Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

96-37-7	Methylcyclopentane
98-82-8	Cumene
71-43-2	Benzene
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
108-87-2	Methyl Cyclohexane
100-41-4	Ethyl Benzene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

25551-13-7	Trimethyl benzene
91-20-3	Naphthalene
96-37-7	Methylcyclopentane
98-82-8	Cumene
71-43-2	Benzene
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
108-87-2	Methyl Cyclohexane
100-41-4	Ethyl Benzene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

25551-13-7	Trimethyl benzene
91-20-3	Naphthalene
96-37-7	Methylcyclopentane
98-82-8	Cumene
71-43-2	Benzene
1330-20-7	Xylene
110-54-3	n-Hexane
108-88-3	Toluene
108-87-2	Methyl Cyclohexane
100-41-4	Ethyl Benzene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Revised Section(s): 1 2 11 April 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a

**MATERIAL SAFETY DATA SHEET**

MSDS No.: BE174
Variant: U.S.A.-EN
Revision: 1.2
Validation Date: 05/20/2011

REFORMER FEED UNFINISHED

Disclaimer

component in another product, this MSDS information may not be applicable.
Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

AP3912
 HER# 2,3,0

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: HEAVY PYROLYSIS GASOLINE

Number: 000000000000016080

Internal ID: AP3912

Chemical characterization: C5-C12 Alkane and Aromatic Hydrocarbons

CAS-No.: 68410-97-9 Mixture

Chemical Name: Heavy Pyrolysis Gasoline

Synonyms: Heavy Pyrolysis Gasoline, Heavy Py Gas

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

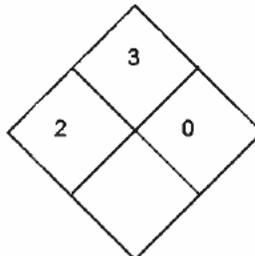
Signal Word

DANGER.

Hazards

Flammable. Contains material which can cause cancer. Reproductive hazard. Aspiration hazard. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state

liquid

Color

colorless to light yellow



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Odor

Gasoline/ hydrocarbon like odor.

Odor Threshold

AIHA reports the odor threshold at 1.6 ppm for toluene.

Potential health effects

Routes of exposure

Eye. Inhalation. Skin. Ingestion.

Acute effects

See component summary.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

- *Xylene 1330-20-7*

May be irritating to the eyes, skin, and respiratory system. Aspiration hazard. Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

- *Ethyl Benzene 100-41-4*

Inhalation hazard. Ingestion hazard. Skin and eye irritant.

- *Isopentane 78-78-4*

This product may cause eye, skin, and respiratory tract irritation. High concentrations may cause central nervous system (CNS) depression. Ingestion would likely cause gastrointestinal tract irritation.

- *n-Pentane 109-66-0*

Aspiration hazard. May cause central nervous system depression.

- *Cyclopentane 287-92-3*

Aspiration hazard. May cause central nervous system depression.

- *Naphthalene 91-20-3*

May be irritating to the eyes, skin and respiratory tract. Direct contact with the eye may cause corneal damage. May be toxic by all routes of exposure. Target organs for toxic effects include the blood, liver, kidneys, eyes, and central nervous system (CNS). Symptoms of overexposure may include headache, restlessness, lethargy, vomiting, anorexia, anemia, diminished vision, and acute kidney failure. Individuals who have an inherited G6PD deficiency in their red blood cells may be particularly sensitive to the toxic effects of Naphthalene. Naphthalene can cross the placenta and harm the fetus.

- *Isoprene 78-79-5*

Harmful if swallowed. May be irritating to the eyes, skin, and respiratory tract. May produce symptoms of CNS depression including headache, dizziness, nausea, loss of sense of balance, drowsiness, and visual disturbances. May lead to potentially fatal cardiac sensitization.

- *Ethyl Toluene 25550-14-5*

May be irritating to the skin.

- *Indene 95-13-6*

May cause drowsiness and dizziness. Aspiration into the lungs may cause chemical pneumonia.

- *n-Heptane 142-82-5*

CNS depressant. Aspiration hazard.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Styrene 100-42-5*

Moderate eye irritant. Moderate skin irritant. It may cause irritation to the respiratory tract and to other mucous membranes. CNS depressant. High concentrations of this substance may cause cardiac arrhythmias that may be fatal. Ingestion hazard. Aspiration hazard

- *Propyl Benzene 103-65-1*

May cause irritation to eyes and skin. May cause drowsiness and dizziness. Aspiration into the lungs may cause chemical pneumonia.

- *Cumene 98-82-8*

Slight eye irritant. Slight skin irritant. Aspiration hazard. CNS depressant.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

- *Trimethyl benzene 25551-13-7*

CNS depressant. Aspiration hazard.

- *Dicyclopentadiene 77-73-6*

Headache, sneezing, and cough may occur. Dicyclopentadiene is an eye skin, and respiratory tract irritant. Exposure to high concentrations may cause nausea, central nervous system (CNS) depression with symptoms such as dizziness, weakness, headache, loss of coordination, loss of consciousness, coma, death and possibly cardiac sensitization. Ingestion of dicyclopentadiene would likely cause gastrointestinal tract irritation. Aspiration into the lung may cause fatal chemical pneumonitis. Can be fatal if large amounts are inhaled or ingested.

- *Allylbenzene 300-57-2*

May cause irritation to skin, eyes, and respiratory tract.

- *N-Octane 111-65-9*

CNS depressant. Aspiration hazard.

- *Vinyl toluene 25013-15-4*

May cause irritation to skin, eyes, and respiratory tract.

- *1,2,4-Trimethylbenzene 95-63-6*

May cause eye and skin irritation. Respiratory tract irritant. CNS depressant. Aspiration hazard.

Skin

May cause irritation to the skin. This irritation can result in redness and swelling of the skin. Repeated contact with the skin may cause it to become dry and cracked.

Inhalation

May cause irritation to the nose, throat and respiratory tract. Depending upon concentration and duration, exposure may also cause dizziness, drowsiness, loss of coordination, coma or suffocation.

Eyes

Can cause eye irritation.

Ingestion

Ingestion would likely cause gastrointestinal tract irritation.

Chronic effects

See component summary.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

- *Xylene 1330-20-7*

May cause dermatitis by defatting the skin from prolonged or repeated contact. May contribute to the development of diseases of the nervous system, liver and kidney. May be a reproductive hazard.

- *Ethyl Benzene 100-41-4*

May effect hearing. Repeated or prolonged exposure may damage liver and kidneys. Possible cancer hazard. Repeated contact with skin may cause cracking and/or fissuring.

- *Isopentane 78-78-4*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. This substance is a developmental toxicant.

- *n-Pentane 109-66-0*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin.

- *Cyclopentane 287-92-3*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin.

- *Naphthalene 91-20-3*

Target organs for toxic effects of chronic exposure include the blood, the skin, the eyes, and the central nervous system. Symptoms of chronic overexposure may include dermatitis, anemia, sores on the eye or cloudiness of the eyeball, diseases involving the nerves or nervous system, and allergic skin reactions. Potential Cancer Hazard, see section 11.

- *Isoprene 78-79-5*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. Has been shown to damage the liver, kidneys and lungs based on animal studies. This substance may have effects on the haematopoietic system, resulting in blood disorders. Isoprene has been classified as a possible human carcinogen.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

- *Ethyl Toluene 25550-14-5*

Specific data not available.

- *Indene 95-13-6*

No known chronic health effects.

- *n-Heptane 142-82-5*

No adverse chronic human health effects have been reported for this material.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Styrene 100-42-5*

This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans). Chronic exposure may result in sensory effects including mild hearing loss, and minor impairment of color vision discrimination. May cause dermatitis by defatting the skin from prolonged or repeated contact.

- *Propyl Benzene 103-65-1*

No known chronic health effects.

- *Cumene 98-82-8*

This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans). Prolonged and/or repeated contact may cause mild to moderate skin defatting, redness, blistering, lesions, and/or scaly dermatitis. May cause kidney and/or lung damage.

- *Trimethyl benzene 25551-13-7*

No adverse chronic human health effects have been reported for this material.

- *Dicyclopentadiene 77-73-6*

Prolonged and repeated exposure to vapors may cause damage to the Central Nervous System, kidneys, liver, and adrenal glands.

- *Allylbenzene 300-57-2*

No known chronic health effects.

- *N-Octane 111-65-9*

No adverse chronic human health effects have been reported for this material.

- *Vinyl toluene 25013-15-4*

May cause dermatitis by defatting the skin from prolonged or repeated contact. Repeated or prolonged exposure may result in liver damage.

- *1,2,4-Trimethylbenzene 95-63-6*

Repeated or prolonged skin contact may defat the skin and produce dermatitis.

Aggravated Medical Condition

Any pre-existing disorders or diseases of the: liver kidney skin blood central nervous system (CNS) eyes lungs and/or pregnancy

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Toluene	108-88-3	203-625-9	<= 35.0
Xylene	1330-20-7	215-535-7	5.0 <= 25.0
Ethyl Benzene	100-41-4	202-849-4	4.0 <= 20.0
Isopentane	78-78-4	201-142-8	<= 15.0
n-Pentane	109-66-0	203-692-4	<= 15.0



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Cyclopentane	287-92-3	206-016-6	<= 10.0
Naphthalene	91-20-3	202-049-5	<= 7.0
Isoprene	78-79-5	201-143-3	<= 6.0
Ethyl Toluene	25550-14-5	247-093-6	1.0 <= 5.0
Indene	95-13-6	202-393-6	<= 4.0
n-Heptane	142-82-5	205-563-8	<= 3.0
Benzene	71-43-2	200-753-7	<= 3.0
Styrene	100-42-5	202-851-5	<= 3.0
Propyl Benzene	103-65-1	203-132-9	1.0 <= 3.0
Cumene	98-82-8	202-704-5	<= 3.0
Trimethyl benzene	25551-13-7	247-099-9	1.0 <= 3.0
Dicyclopentadiene	77-73-6	201-052-9	<= 3.0
Allylbenzene	300-57-2	206-095-7	<= 2.0
N-Octane	111-65-9	203-892-1	<= 1.0
Vinyl toluene	25013-15-4	246-562-2	<= 1.0
1,2,4-Trimethylbenzene	95-63-6	202-436-9	<= 1.0

Typical composition

4. FIRST AID MEASURES

General advice

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Immediately remove excess chemical and contaminated clothing; thoroughly wash contaminated skin with mild soap and water. If irritation persists after washing, seek medical attention. Thoroughly clean contaminated clothing before reuse; discard contaminated leather goods (gloves, shoes, belts, wallets, etc.).

Inhalation

Move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. When breathing is difficult, properly trained personnel may assist the affected person by administering oxygen. Keep the affected person warm and at rest. Get medical attention immediately.

Eyes

Thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persists, seek medical attention.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to reduce risk of aspiration. Get medical attention immediately.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Notes to physician

Do not induce vomiting. However, if vomiting occurs spontaneously, maintain open airway. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax. Gastrointestinal decontamination in accidental petroleum distillate ingestions is not recommended, because of the severe aspiration hazard. Gastric lavage is indicated in those patients who require decontamination. Be sure that an endotracheal tube is in place prior to lavage; use cuffed tubes in patients over 7 years of age.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

< -40.0 °C (-40 °F) closed cup

Autoignition temperature

498 °C (928.4 °F)

Lower explosion limit

1.2 vol%

Upper explosion limit

7 vol%

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemicals, CO₂, or foam. LARGE FIRE: Use water spray, water fog or foam. DO NOT use straight streams

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

Vapors may travel long distances along the ground before reaching a source of ignition and flashing back. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Move containers from fire area if you can do it without risk. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Hazardous combustion products

Carbon oxides (CO, CO₂)

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Flammable liquid. Eliminate all sources of ignition. Release can cause fire/explosion/health/environmental hazards. Evacuate/limit access. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

7. HANDLING AND STORAGE

Handling

Do not handle near heat, sparks, or flame. Avoid contact with incompatible agents. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin and clothing. Do not enter storage area unless adequately ventilated. Metal containers involved in the transfer of this material should be grounded and bonded. Special slow load procedures for 'switch loading' must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point hydrocarbon products. Electrostatic charges may be generated as a result of flow or agitation.

Storage

Keep containers tightly closed when not in use and store in a well-ventilated area. Isolate incompatible materials such as oxidizers. Containers should be clearly labeled. Metal containers used to store this material should be grounded. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance. This liquid may accumulate static electricity even when transferred into properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits.

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Skin

Wear chemical resistant gloves such as: Viton(TM). When skin contact is possible, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. The equipment must be cleaned thoroughly after each use.

Eyes

Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid, airborne particles, or vapor.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Clothing that has become saturated with the product must be removed immediately because the product is absorbed through the skin. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Wash clothing frequently.

Occupational Exposure Limits

Consult local authorities for acceptable exposure limits.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid colorless, to, light yellow

Odor: Gasoline/ hydrocarbon like odor.

Odor Threshold: AIHA reports the odor threshold at 1.6 ppm for toluene.

pH: Not applicable.

Boiling point/boiling range: 30 - 229 °C (86 - 444.2 °F)

Melting/freezing point: -46 °C (-50.8 °F)

Flash point: < -40.0 °C (-40 °F) closed cup

Autoignition temperature: 498 °C (928.4 °F)

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: 1.2 vol%

Upper explosion limit: 7 vol%

Explosive properties: No Data Available.

Oxidizing properties: No Data Available.

Vapor pressure: RVP = 11 psia max

Evaporation rate: no data available

Relative density: 0.8 - 0.9(Water = 1)

Relative vapor density: no data available

Viscosity: No Data Available.

Water solubility: Slightly soluble

Partition coefficient: n-octanol/water: No Data Available.

Other physico-chemical properties: No additional information available.

10. STABILITY AND REACTIVITY

Chemical stability
 The product is stable.

Conditions to avoid
 Avoid contact with strong oxidizers, excessive heat, sparks or open flame.

Materials to avoid
 Does not react with common materials.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Hazardous decomposition products

No degradation data available.

Hazardous polymerization

Will not occur.

Reactions with Air and Water

Does not react with air or water.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

See components summary.

COMPONENT INFORMATION

- *Toluene* 108-88-3

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

- *Xylene* 1330-20-7

Acute toxicity

<u>LC50 (Inh)</u>	rat	5000 PPM	4 HOURS
	mouse	3907 MG/KG	6 HOURS
	rat	4550 PPM	4 HOURS

LD50 (Oral) rat 4300 MG/KG

LD50 (Skin) rabbit >1700 MG/KG

Irritation

Skin

Moderate skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

This material is expected to be a mild eye irritant. Xylenes are irritating to the eyes with the potential to cause conjunctivitis and corneal opacity.

Target Organs

Skin. Eye. central nervous system (CNS)

Repeated dose toxicity

Repeated inhalation exposures of rats to xylenes cause liver effects at 920 ppm (4.0 mg/L) and ototoxicity at \geq 800 ppm (3.48 mg/L). Repeated oral exposures to xylenes produce reductions in bodyweight in male rats at 500 mg/kg bwt/day, liver effects and hyaline droplet formation in male rats at \geq 150 mg/kg bwt/day, kidney effects in male and female rats at \geq 750 mg/kg bwt/day, and a reduction in bodyweight gain in male mice at \geq 250 mg/kg bwt/day. Repeated inhalation exposures of gerbils to \geq 160 ppm (0.70 mg/L) xylenes cause apparently irreversible CNS effects.

Reproductive effects

A reproductive toxicity study, two dominant lethal studies, and evaluation of reproductive organs in repeated dose studies indicate that xylenes do not affect reproductive performance or induce structural damage to reproductive organs of laboratory animals at non-anesthetic doses. However, xylenes have been shown to produce damage to reproductive organs in rats repeatedly exposed to extremely high, anesthetic doses.

Developmental Toxicity

Results from animal studies demonstrate that xylenes may cause reduced fetal weight and delayed ossification, but not



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

malformations, at inhalation dose levels causing no or only slight maternal toxicity (≥ 115 ppm or 0.5 mg/L). Slight neurobehavioral effects were noted in offspring of rats exposed to 500 ppm (2.2 mg/L) in the absence of maternal toxicity.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Ethyl Benzene* 100-41-4

Acute toxicity

<u>LC50 (vapor)</u>	rat	4000 PPM
<u>LD50 (Oral)</u>	rat	3500 - 4700 MG/KG BWT
<u>LD50 (Skin)</u>	rabbit	> 15,000 MG/KG BWT

Acute effects

Inhalation

Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract. High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization. Aspiration may cause pulmonary edema and pneumonitis.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring. While skin absorption is a potential route of exposure, no adverse health effects are anticipated following accidental or incidental contact.

Irritation

Skin

This product is expected to be an skin irritant.

Eyes

Moderate to severe eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Eye. Skin. Central nervous system. Lung. Liver. Kidneys. Thyroid. Blood. Hearing. heart

Repeated dose toxicity

No adverse effects were present in rats or mice exposed to 1000 ppm (4.3 mg/l) ethylbenzene vapor for up to 13 weeks. Longer-term exposure resulted in an increased incidence of chronic progressive nephropathy (CPN) in kidneys from rats inhaling 750 ppm (3.3 mg/l) for up to two years. Since CPN is a spontaneous age-related condition specific to rodents, these findings are of doubtful relevance to humans. Mice exposed chronically under similar conditions responded with changes in the lung, liver and thyroid. Additional effects in rats observed with repeated oral exposure of ≥ 250 mg bwt/day ethyl benzene for 90 days include changes in hematology (indicative of a mild regenerative anemia) and clinical chemistry parameters (indicative of hepatic microsomal enzyme induction), decreases in prothrombin time, mild alimentary effects and liver pathology. A standard neurotoxicity protocol study conducted in young adult rats did not find neurotoxic effects following repeated daily oral exposure to doses up to 500 mg/kg bwt/day.

Specialist investigations provide evidence of hearing loss in rats following repeated exposure (13 weeks) to concentrations of 200 ppm (0.85 mg/l) and above. Ethyl benzene at up to 500 ppm vapor concentration did not adversely affect the functional ability of the humoral component of the immune system of rats as measured by splenic IgM antibody forming cell response to the T-dependent antigen, sheep erythrocytes.

Reproductive effects

No parental, neonatal, or reproductive toxicity was observed following inhalation exposure of rats to up to 500 ppm or 500 ppm/342 mg/kg bwt/day ethylbenzene. Histopathological examination of reproductive tissue from rats, mice and rabbits has generally revealed no adverse changes following sub-chronic- or chronic inhalation exposure to high vapor concentrations.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

An increased incidence of testicular tumors in F344 male rats exposed to 750 ppm (3.3 mg/l) ethylbenzene vapor for 2 years is considered of doubtful relevance to reproductive toxicity.

Developmental Toxicity

Decreased fetal body weight and an increased occurrence of skeletal and other variations were reported in the presence of concurrent maternal toxicity (CNS effects, decreased body weight, liver enlargement) when female rats were exposed to ethylbenzene concentrations of 1000 ppm (4.3 mg/l) or above throughout pregnancy. No adverse effects to neurodevelopment were observed in rats exposed to 500 ppm/342 mg/kg bwt/day ethylbenzene.

Genetic Toxicity

No increase in micronuclei or hepatic UDS was observed in mice after treatment with ethylbenzene in vivo. It was not genotoxic in microbial systems, nor did it induce chromosomal aberrations or sister chromatid exchanges in mammalian cells in vitro. Variable results were obtained for mutation at the TK+/- locus in L5178Y cells, although the most reliable study that utilized the current standard study protocol and doses that were not significantly cytotoxic gave a negative mutagenic response. The overall weight of evidence indicates that ethylbenzene is not genotoxic.

Carcinogenicity

The carcinogenic potential of ethylbenzene after inhalation exposure has been investigated in two recent regulatory guideline studies performed by NTP. Male rats exposed to 750 ppm (3.3 mg/l) over 2 years showed an increased incidence of testicular interstitial cell adenoma, a common tumor present also in a large majority of the untreated males included in the study. High level exposure was also linked with an increased incidence of kidney tumors in both sexes; the appearance of these lesions was strongly associated with the development of Chronic Progressive Nephropathy, a spontaneous age-related disease of rats with no equivalent counterpart in humans. Male mice exposed to 750 ppm ethylbenzene for 2 years responded with an increased incidence of lung tumors, while the incidence of liver tumors was increased in females. Mechanistic studies suggest that these lesions in the mouse developed secondary to enhanced cell proliferation in these tissues, while the weight of evidence from mutagenicity testing also indicates that a non-genotoxic mechanism was involved. Listed by IARC as possibly carcinogenic in humans (Group 2B).

- *Isopentane* 78-78-4

Acute toxicity

<u>LC50 (Inhl)</u>	mouse	413 MG/L	2 HOURS
	rat	1281.9 MG/L	4 HOURS

Irritation

Skin

Defatting of the skin with irritation, dryness and cracking.

Eyes

Slight eye irritant.

Target Organs

Skin. Eye.

Repeated dose toxicity

Repeated oral gavage exposures of rats to 500 mg/kg bwt/day isopentane produced lethality and decreases in bodyweight gain.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *n-Pentane* 109-66-0

Acute toxicity

<u>LC50 (Inhl)</u>	rat	> 18.02 MG/L	4 HOURS
<u>LD50 (Oral)</u>	rat	> 2000 MG/KG BWT	
<u>LD50 (Skin)</u>	rabbit	3000 MG/KG	

Target Organs

Respiratory system. Kidneys.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Repeated dose toxicity

No treatment-related effects were observed in a 90-day inhalation study in rats exposed to n-pentane at up to 6778 ppm (20 mg/L). Inhalation neurotoxicity evaluations in rats exposed to n-pentane at 3000 ppm (8.9 mg/L) for up to 30 weeks found no evidence of neurotoxicity. Repeated oral gavage exposures of rats to 500 mg/kg bwt/day n-pentane produced lethality, decreases in bodyweight gain and slightly lower kidney weights.

Reproductive effects

No effects on reproductive organs were observed in a 90-day inhalation study in rats exposed to n-pentane at ~7000 ppm (20 mg/L). n-Pentane was negative in a dominant lethal test in mice when males were given a single intraperitoneal injection of 48-666 mg/kg bwt.

Developmental Toxicity

No developmental toxicity was observed when pregnant rats were exposed to n-pentane by oral administration of 1000mg/kg bwt/day or by inhalation of 10000 ppm (29.5 mg/L).

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Cyclopentane* 287-92-3

Acute toxicity

<u>LC50 (Inh)</u>	rat	106 GM/M3
<u>LD50 (Oral)</u>	rat	11,400 MG/KG

Acute effects

Inhalation

Specific data not available.

Ingestion

Specific data not available.

Skin contact

Specific data not available.

Irritation

Skin

Specific data not available.

Eyes

Specific data not available.

Target Organs

Skin. Central nervous system. Lung.

Repeated dose toxicity

Sensitive individuals may exhibit skin rash, wheezing, tightness of the chest, and difficulty breathing that may progress to a life-threatening inability to breathe.

Reproductive effects

No effects on reproductive organs were observed in a 90-day inhalation study with rats exposed to ~10,200 ppm (29.8 mg/L).

Genetic Toxicity

Cyclopentane was negative in the Ames Test and mouse lymphoma assay and in an in vivo micronucleus test, but induced chromosome aberrations in an in vitro mammalian cell assay.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

Other information

No data available.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

- *Naphthalene* 91-20-3

Acute toxicity

<u>LC50 (Inhl)</u>	rat	>340 MG/M3	4 HOUR
<u>LD50 (Oral)</u>	rat	490 MG/KG	
	mouse	533 MG/KG	
	guinea pig	1200 MG/KG	

Irritation

Skin

May be irritating to the skin.

Eyes

May cause eye irritation.

Repeated dose toxicity

Repeated inhalation or ingestion of naphthalene causes methemoglobine*

Developmental Toxicity

Results from repeated dose oral gavage tests with naphthalene showed fetotoxicity in rats (increase in resorptions at 450 mg/kg bwt/day) and in mice (decrease in number of live pups/litter at 300 mg/kg bwt/day) in the presence of maternal toxicity (reduction in body weight gains in rats; decrease in survival and reduction in body weight in mice).

Genetic Toxicity

Naphthalene produced chromosome damage in in vitro assays, but not in in vivo assays in which mice were administered 500 mg/kg bwt orally or 250 mg/kg bwt by intraperitoneal injection.

Carcinogenicity

The National Toxicology Program (NTP) has evaluated this substance and placed it in Group R: Reasonably Anticipated To Be A Human Carcinogen. The International Agency for Research on Cancer (IARC) has evaluated this substance and placed it in Group 2B (possibly carcinogenic to humans).

- *Isoprene* 78-79-5

Acute toxicity

<u>LC50 (Inhl)</u>	rat	180 MG/L	4.0 HOURS
	mouse	157 MG/L	2.0 HOURS
<u>LD50 (Oral)</u>	rat	2043 - 2210 MG/KG BWT	

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

Harmful if swallowed.

Skin contact

No Data Available.

Irritation

Skin

Liquid slightly irritating to skin. Repeated contact with neat product may dry the skin causing cracking and/or fissuring.

Eyes

No data on eye irritation found.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Liver, Lung, Kidneys, Testes.

Repeated dose toxicity

Isoprene produces adverse effects in a range of tissues (including Harderian gland, forestomach, liver, lung, spleen, hematopoietic system, mesenteric lymph node, testis and nose/nasal cavity) in mice after repeated inhalation exposure (greater than or equal to 70 ppm), whereas, in rats at higher exposures (greater than or equal to 700 ppm), lesions are limited to testes, kidney and spleen.

Reproductive effects

Following repeated inhalation of isoprene vapor, the only exposure-related effects reported in rats were slight increases in testicular hyperplasia at 7000 ppm. In mice, the following effects were noted: testicular atrophy (greater than or equal to 280 ppm); reductions in epididymal weights, spermatid head counts/concentrations, and sperm motility (greater than or equal to 700 ppm); and increased estrous cycle lengths (7000 ppm).

Developmental Toxicity

Results from studies with rats and mice demonstrate that isoprene is not a teratogen. Reduced fetal bodyweight has been observed in mice exposed to greater than or equal to 280 ppm isoprene vapor during pregnancy.

Genetic Toxicity

Isoprene is genotoxic in the mouse, inducing micronuclei in bone marrow after inhalation exposure at greater than or equal to 438 ppm, the lowest dose tested.

Carcinogenicity

Animal data demonstrate marked species difference in carcinogenic response to isoprene. In the mouse, long term inhalation exposure is associated with an increased incidence of benign and malignant cancers in a wide range of tissues, whereas, in the rat, only benign tumors in testes, kidney and mammary gland have been seen. The lowest exposure concentrations that were carcinogenic to rats and mice were 220 ppm and 70 ppm, respectively. Listed by IARC as possibly carcinogenic to humans (Group 2B). This listing is based on sufficient evidence of carcinogenicity in experimental animals. Listed by NTP as reasonably anticipated to be a human carcinogen in their Report on Carcinogens 10th Edition. This listing was based on sufficient evidence of tumor formation at multiple organ sites in multiple species of experimental animals.

- *Ethyl Toluene* 25550-14-5

Acute toxicity

<u>LC50 (Inhl)</u>		50	2 HOURS
	mouse	54	4 HOURS

Irritation

Skin

Skin irritant.

Repeated dose toxicity

Repeated exposure may cause liver and kidney damage.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Indene* 95-13-6

Acute toxicity

<u>LC50 (Inhl)</u>	rat	14 GM/M3
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Carcinogenicity

Specific data not available.

- *n-Heptane* 142-82-5

Acute toxicity

<u>LC50 (Inhl)</u>	rat	103 GM/M3	4 HOURS
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MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

LD50 (Oral) mouse 5000 MG/KG

LD50 (Skin) rabbit 3000 MG/KG

Target Organs

Central nervous system. Lung.

- *Benzene* 71-43-2

Acute toxicity

rat 13,700 PPM 4 HOURS

rabbit > 8260 MG/KG BWT

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered bodyweight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiologist studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Styrene* 100-42-5

Acute toxicity

rat ~ 5000 MG/KG

Acute effects



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Inhalation

Vapors are toxic when inhaled. Vapors may cause irritation of the eyes, nose and throat as well as CNS depression (primarily fatigue, dizziness and loss of concentration, with collapse, coma and death in cases of severe over-exposure) May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Ingestion

This substance is of low acute toxicity when administered orally. Ingestion may cause discomfort and irritation of the gastrointestinal tract, effects on lungs and kidneys, and CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe overexposure) Aspiration into the lung may cause fatal chemical pneumonitis. May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Target Organs

Cardiac sensitization. Nervous system Nasal cavity. Lungs Eyes Skin

- *Propyl Benzene* 103-65-1

Acute toxicity

LC50 (Inhl) rat 65000 PPM 2 HOURS

LD50 (Oral) rat 6040 MG/KG

- *Cumene* 98-82-8

Acute toxicity

LC50 (Inhl) rat 39000 MG/M3 4 HOURS

LD50 (Oral) rat 1400 MG/KG

LD50 (Skin) rabbit > 3160 MG/KG

Irritation

Skin

Slight skin irritant. May cause dermatitis by defatting the skin from prolonged or repeated contact.

Eyes

Slight eye irritant.

Sensitization

Not expected to be a sensitizer.

Target Organs

Central nervous system. Skin. Eye. Respiratory system. Nasal cavity. Kidney Liver Lungs

Reproductive effects

This substance is not expected to be a reproductive toxicant.

Genetic Toxicity

Negative for genotoxicity using both in vitro and in vivo tests.

Carcinogenicity

The NTP has found that Cumene causes increased incidences of combined benign and malign kidney tumors in male rats, and malignant lung tumors in mice of both sexes. This material has been classified by IARC as a group 2B substance (possibly carcinogenic to humans).

- *Trimethyl benzene* 25551-13-7

Acute toxicity

LD50 (Oral) rat 8970 MG/KG

Irritation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Skin

Skin irritant.

- *Dicyclopentadiene* 77-73-6

Acute toxicity

<u>LC50 (Inhl)</u>	rat	359-660 PPM	4 HOURS
	rat	284 PPM MALE	6 HOURS
	rat	353 PPM FEMALE	6 HOURS
	mouse	145 PPM	4 HOURS
	mouse	143 PPM MALE	6 HOURS
	mouse	130 PPM FEMALE	6 HOURS

<u>LD50 (Oral)</u>	rat	347-820 MG/KG
	mouse	190-250 MG/KG

<u>LD50 (Skin)</u>	rabbit	>2000 MG/KG
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Acute effects

Inhalation

High doses may cause CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure).

Ingestion

Ingestion of high doses may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure). Ingestion of this material, followed by vomiting and aspiration of the more volatile components of this material into the lungs, may lead to chemical pneumonia and even death.

Skin contact

No adverse systemic effects are anticipated following accidental or incidental skin contact; however, severe overexposure to the skin may cause CNS depression and death.

Irritation

Skin

Liquid is irritating to skin. Repeated contact with neat product may dry the skin causing cracking and/or fissuring.

Eyes

Slight eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects. Gastrointestinal tract. Kidneys. Liver. Adrenal glands.

Repeated dose toxicity

Repeated inhalation exposures to dicyclopentadiene produced lethality in mice at ≥ 51 ppm and in rats at ≥ 250 ppm. At non-lethal concentrations, inhalation exposure of mice, rats and dogs produced CNS effects in mice at ≥ 5 ppm and in dogs at ≥ 47 ppm, decreased bodyweight gain in rats at 100 ppm, liver effects in male rats at ≥ 19.7 ppm, and kidney effects in male rats at ≥ 1 ppm. Repeated oral gavage exposures to rats produced lethality and liver effects at 100 mg/kg bwt/day and, at lower concentrations, effects on the adrenal gland (≥ 20 mg/kg bwt) and, in males, kidney (≥ 4 mg/kg bwt). The kidney lesions appear to be hyaline droplet nephropathy, a male rat specific disease not considered relevant to humans.

Reproductive effects

In repeated dose oral gavage studies in rats, effects on reproductive parameters (failure to nurse resulting in litter loss, increased days to litter, pup mortality, lower pup weights) were observed only in the presence of maternal toxicity (lethality, decreased bodyweight, and increased liver weight) at 100 mg/kg bwt/day.

Developmental Toxicity

Results from repeated dose oral gavage tests showed signs of fetotoxicity (decreased viability, lower birth and body



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

weights) in rats at ≥ 100 mg/kg bwt/day, and teratogenicity (deformed hind legs) in rabbits at 400 mg/kg bwt/day, but only at doses causing maternal lethality.

Genetic Toxicity

The weight of experimental evidence indicates that dicyclopentadiene is not genotoxic in bacterial, yeast or mammalian cell systems in vitro.

Carcinogenicity

No Data Available.

- *Allylbenzene* 300-57-2

Acute toxicity

LD50 (Oral) rat 5,540 MG/KG

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *N-Octane* 111-65-9

Acute toxicity

LC50 (Inhl) rat 118 GMM3

Target Organs

Skin. Eye. Respiratory system. Central nervous system effects.

Repeated dose toxicity

Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Carcinogenicity

Not listed by IARC, NTP, OSHA or EPA.

- *Vinyl toluene* 25013-15-4

Acute toxicity

LD50 (Oral) rat 2255 MG/KG

Irritation

Skin

Neat liquid is moderately irritating to skin.

Repeated dose toxicity

Repeated inhalation exposures of rats to vinyl toluene cause reductions in body weight and toxicity to the nasal tract at ≥ 100 ppm (0.48 mg/L); nephropathy in males at ≥ 160 ppm (0.77 mg/L); liver effects at ≥ 1000 ppm (4.83 mg/L); and lung effects at 1300 ppm (6.28 mg/L). Repeated inhalation exposures of mice to vinyl toluene cause reductions in body weight and toxicity to the nasal tract at ≥ 10 ppm (0.048 mg/L); lung effects at 160 ppm (0.77 mg/L); and liver effects and death at 200 ppm (0.97 mg/L). In rats repeatedly exposed by inhalation to vinyl toluene, there was some evidence for neurotoxicity (decreased motor conduction velocity) at ≥ 100 ppm (0.48 mg/L).

Reproductive effects

Specific data not available.

Developmental Toxicity

Specific data not available.

Genetic Toxicity

Vinyl toluene produced positive results for gene mutation in mouse lymphoma cells and chromosome damage in human lymphocytes, and was positive in a mouse micronucleus test after intraperitoneal dosing at 200 mg/kg bwt.

Carcinogenicity

Toluene is listed by OSHA and NTP as "Not classifiable as a Human Carcinogen".



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

- *1,2,4-Trimethylbenzene* 95-63-6

Acute toxicity

LC50 (Inhl) rat 18 G/M3 4 HOURS

Target Organs

Eye. Skin. Respiratory system. Central nervous system. Blood.

Repeated dose toxicity

Repeated inhalation exposures to 1,2,4-trimethyl-benzene causes changes in hematological parameters in male rats at 250 ppm (1.23 mg/L); and pulmonary lesions in male and female rats at ≥ 100 ppm (1.23 mg/L).

Developmental Toxicity

Results from a repeated dose inhalation test with trimethylbenzene showed fetotoxicity in rats (decreased pup bodyweight) at ≥ 600 ppm (2.95 mg/L) in the presence of maternal toxicity (reduced body weight gain).

Genetic Toxicity

Trimethylbenzene was positive in a bacterial gene mutation assay and produced sister chromatid exchanges in mouse bone marrow (at ≥ 730 mg/kg bwt), but did not induce micronuclei in the same cells.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

See component summary.

Environmental fate and pathways

When released into the environment, this material will volatilize rapidly. This material will biodegrade relatively rapidly in both soil and water, and will not persist in the environment. Due care should be taken to avoid accidental releases to aquatic or terrestrial systems.

Persistence and degradability

Bioaccumulation: See component summary.

COMPONENT INFORMATION

- *Toluene* 108-88-3

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 55 mg/l

LC50 / 96 HOUR *Carassius auratus* 22.8 mg/l

LC50 / 96 HOUR *Pimephales promelas* 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 11.5 - 14.9 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l
 Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY Daphnia magna. 1.0 mg/l

NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

- *Xylene* 1330-20-7

Ecotoxicity

This material is classified as harmful to fish.

Acute Fish toxicity

LC50 / 96 HOUR rainbow trout. 13.5 mg/l

LC50 / 24 HOUR goldfish 13 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone. Expected to have moderate mobility in soils. Volatilization from moist soil surfaces is expected. Volatilization from dry soil surfaces is expected.

Persistence and degradability

Biodegradation: Biodegradable under aerobic and anaerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Ethyl Benzene* 100-41-4

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 4.2 mg/l

LC50 / 96 HOUR *Menidia menidia* 5.1 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 9.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR *Daphnia magna*. 1.8 - 2.9 mg/l

EC50 / 48 HOUR *Artemia salina* 9.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 4.6 mg/l

EC50 / 96 HOUR *Selenastrum capricornutum* 3.6 mg/l

EC50 / 96 HOUR *Skeletonema costatum* 7.7 mg/l

Toxicity to microorganisms

IC50 / 48 HOUR Sewage sludge 130 mg/l

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC50 (reproduction) / 7 DAY *Ceriodaphnia dubia* 3.3 mg/l

NOEL (reproduction) / 7 DAY *Ceriodaphnia dubia* 1.0 mg/l

Summary: May exhibit chronic toxicity in specific invertebrates.

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of ethylbenzene (half-life approx. 1 day). In water, volatilization to air and biodegradation will result in substantial losses, with an estimated half-life of approx. 0.1 - 13 days.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Isopentane* 78-78-4

Ecotoxicity

This material is toxic to aquatic organisms.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 2.3 mg/l

Environmental fate and pathways

This material is likely to evaporate from soil and water.

Persistence and degradability

Stability in water: Volatilization from water surfaces is expected to be an important environmental fate process.

Stability in soil: Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Biodegradation: This material is expected to be biodegradable.

Bioaccumulation: This material is not expected to bioaccumulate.

- *n-Pentane* 109-66-0

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss 4.3 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS waterflea. 9.7 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

Persistence and degradability

Stability in soil: Volatilization from moist soil surfaces is expected to be an important fate process of this material.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Cyclopentane* 287-92-3

Ecotoxicity

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 10.5 mg/l

Environmental fate and pathways

Hydrolysis is not expected to be an important factor in the environmental fate process for this material. It is not expected to adsorb onto soils or sediments. Limited biodegradation. Expected to have high mobility in soils. This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

- *Naphthalene* 91-20-3

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Acute Fish toxicity

LC50 / 96 HOURS rainbow trout. 26 mg/l

Summary: Very toxic to aquatic organisms.

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 21.9 mg/l

Environmental fate and pathways

Persistence and degradability

Biodegradation: Biodegradable under aerobic conditions.

Bioaccumulation: Naphthalene has a moderate tendency to bioaccumulate although fish and microorganisms readily metabolize it.

- *Isoprene* 78-79-5

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS Oncorhynchus mykiss 7.43 mg/l

Acute toxicity to aquatic invertebrates

LC50 / 48 HOURS Daphnia magna. 5.77 mg/l

Summary: This material is toxic to aquatic invertebrates (acute exposure). Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

Toxicity to aquatic plants

NOEC / 72 HOURS algae 15.5 mg/l

Summary: Biomass Production

EC50 / 72 HOURS algae > 35.2 mg/l

Summary: growth rate reduction Substantive aquatic exposure is not likely based on the volatile nature of this chemical. This material is harmful to algae or higher aquatic plants.

NOEC / green algae. 1.7 mg/l

Summary: Biomass Production

NOEC / green algae. 6.0 mg/l

Summary: growth rate reduction

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

2.81 mg/l

Summary: Calculated Fish 30-day Chronic Toxicity Value (Predicted, Isoprene): 2.81 mg/L

Chronic toxicity to aquatic invertebrates

EC50 / 16 d daphnids. 1.38 mg/l

Summary: Calculated

LC50 / 14 d Earthworm

Summary: Calculated 311 mg/kg



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Environmental fate and pathways

Persistence and degradability

Stability in water: In the aquatic environment, isoprene is expected to adsorb to suspended solids and sediments. Volatilization from water surfaces expected based on isoprene's vapor pressure and water solubility. Based on specific gravity, isoprene is expected to float on water (in case of a spill) and rapidly evaporate.

Stability in soil: Expected to have moderate mobility in soil, with volatilization from moist soil surfaces expected to be an important fate process based on isoprene's vapor pressure of 493 mm Hg at 20°C and water solubility of 300 mg/L at 20°C.

Biodegradation: Not readily biodegradable. In the atmosphere, isoprene degrades in reactions with photochemically-produced hydroxyl radicals, ozone molecules, and nitrate radicals with a half-life of 1.2 hours. Does not undergo hydrolysis.

Bioaccumulation: Bioconcentration factor (BCF) 15 (estimated) Low potential for bioconcentrating/bioaccumulating in aquatic organisms based on a log Kow of 2.42 and an estimated BCF of 15. Half-life in soil estimated to range from 7 to 28 days.

- *Ethyl Toluene* 25550-14-5

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Indene* 95-13-6

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *n-Heptane* 142-82-5

Ecotoxicity

This material may be very toxic to aquatic species.

Acute Fish toxicity

LC50 / 24 HOUR goldfish 4 mg/l

LC50 / 96 HOURS Cichlid fish 375 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS Daphnia magna. > 10 mg/l

Environmental fate and pathways



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

This material is expected to exist solely as a vapor in the ambient atmosphere. The vapor-phase of this material is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and ozone.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Stability in soil: This material is expected to have slight mobility in soil.

Biodegradation: No data available.

Bioaccumulation: This material may bioaccumulate.

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

/ 96 HOURS *Oncorhynchus mykiss* (rainbow trout) 5.3 mg/l

Acute toxicity to aquatic invertebrates

/ 48 HOURS *Daphnia magna*. 10 mg/l

Toxicity to aquatic plants

/ 72 HOURS *Pseudokirchneriella subcapitata* (green algae) 32 mg/l

Toxicity to microorganisms

/ 24 HOURS *Nitrosomonas* sp. 13 mg/l

Chronic toxicity to fish

/ 32 DAY *Pimephales promelas* 1.6 mg/l

Chronic toxicity to aquatic invertebrates

/ 7 DAY *Ceriodaphnia dubia* 3 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for bioaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Styrene* 100-42-5

Ecotoxicity

Toxic to fish, invertebrates and microorganisms, however, substantial aquatic exposure is not expected based on the volatile nature of this material.

Acute Fish toxicity

/ 96 HOUR *Pimephales promelas* (fathead minnow) 4.02 mg/l

Summary: Toxic to fish.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Acute toxicity to aquatic invertebrates

/48 HOUR Daphnia magna. 4.7 mg/l

Summary: This material is toxic to aquatic invertebrates (acute exposure).

Toxicity to aquatic plants

/72 HOUR Pseudokirchneriella subcapitata 4.9 mg/l

Chronic toxicity to aquatic invertebrates

/21 d Daphnia magna (Water flea) 1.01 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for releases of styrene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of approximately 3 hours. A calculated Koc value of 352 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: This material is not expected to bioaccumulate.

- *Propyl Benzene* 103-65-1

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Cumene* 98-82-8

Ecotoxicity

This material is toxic to fish. It may cause long term adverse effects in the aquatic environment.

Acute Fish toxicity

LC50 /96 HOURS Pimephales promelas (fathead minnow) 6.04 - 6.61 mg/l

Summary: flow-through test

LC50 /96 HOURS Oncorhynchus mykiss (rainbow trout) 4.8 mg/l

Summary: flow-through test

LC50 /96 HOURS Oncorhynchus mykiss (rainbow trout) 2.7 mg/l

Summary: semi-static test

LC50 /96 HOURS Poecilia reticulata (guppy) 5.1 mg/l

Summary: semi-static test

Acute toxicity to aquatic invertebrates

EC50 /48 HOURS Daphnia magna (Water flea) 0.6 mg/l

EC50 /48 HOURS Daphnia magna (Water flea) 7.9 - 14.1 mg/l



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Toxicity to aquatic plants

EC50 / 72 HOURS *Pseudokirchneriella subcapitata* 2.6 mg/l

Environmental fate and pathways

This material is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals. It may adsorb onto soils or sediments. Volatilization from water surfaces is expected to be an important environmental fate process. Volatilization from moist soil surfaces is expected.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: This material is expected to be readily biodegradable.

Bioaccumulation: Bioconcentration factor (BCF) ~ 35 BCF ~ 35.0

- *Trimethyl benzene* 25551-13-7

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *Dicyclopentadiene* 77-73-6

Ecotoxicity

Acute Fish toxicity

LC50 / 48 HOURS Japanese medaka 3.7 mg/l

Summary: This material is toxic to fish.

Acute toxicity to aquatic invertebrates

LC50 / 48 HOUR *Daphnia magna*. 10.5 mg/l

Summary: This material is toxic to aquatic invertebrates (acute exposure). Substantive aquatic exposure is not likely based on the volatile nature of this chemical.

Toxicity to aquatic plants

EC50 / 72 HOURS green algae (*Selenastrum*). 27 mg/l

Summary: This material is harmful to algae or higher aquatic plants.

Toxicity to microorganisms

IC50 / 24 HOURS Protozoa 5.3 mg/l

Chronic toxicity to fish

NOEC / 14 d bluegill sunfish > 1 mg/l

Summary: Not expected to exhibit chronic toxicity to fish.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Chronic toxicity to aquatic invertebrates

EC50 / 21 d Daphnia magna. 4.0 mg/l

Summary: Reproduction rate. Not expected to exhibit chronic toxicity to aquatic invertebrates.

Summary: Limited data are available which indicate this stream may be toxic to aquatic invertebrates during chronic exposure.

Environmental fate and pathways

Not readily biodegradable, although some microbial decomposition may take place. In water, the volatilization half-life of DCPD from model waterways (lake, pond, river) is estimated to be between 1.3 and 9.9 days. The half-life of DCPD through indirect phototransformation in natural water is estimated to be 76 days. In air, the estimated photodegradation half-life of DCPD is 0.1 days. Bioaccumulation is expected to occur at low levels based on an estimated fish BCF ranging from 11 to 53.

Persistence and degradability

Stability in soil: Low mobility in soil. Expected to volatilize from dry or moist soil surfaces, although some adsorption to soil may occur. Volatilizes from water. May adsorb to sediment and organic matter.

Biodegradation: May biodegrade under aerobic conditions with acclimated microbes. In the atmosphere, the stream chemicals will react readily with hydroxyl radicals (calculated half-life range 1.1-31.8 hours). Direct photodegradation and hydrolysis are not likely to be important fate processes.

- *Allylbenzene* 300-57-2

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- *N-Octane* 111-65-9

Ecotoxicity

No Data Available.

Environmental fate and pathways

When released into the environment, this material will volatilize rapidly. This material is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals. Limited biodegradation.

Persistence and degradability

Stability in water: In aquatic systems, this material may partition from the water column to organic matter contained in sediments and suspended materials.

Biodegradation: This material is not expected to be readily biodegradable.

Bioaccumulation: Bioconcentration factor (BCF) < 5 BCF < 5

- *Vinyl toluene* 25013-15-4



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Ecotoxicity

No data available.

Environmental fate and pathways

No data available.

- 1,2,4-Trimethylbenzene 95-63-6

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOURS fathead minnow 7.72 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOURS Daphnia magna. 6.14 mg/l

Environmental fate and pathways

No Data Available.

13. DISPOSAL CONSIDERATIONS

Disposal should be conducted through a facility equipped with and operating an air emission control device in accordance with requirements of applicable Clean Air Act regulations.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Petroleum distillates, n.o.s. (TOLUENE, XYLENE)

Reportable quantity TOLUENE
 XYLENE

ID No. UN1268

Hazard class 3

Packing group II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

China	IECS
European Union	EINECS
Japan	ENCS/ISHL
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below. Export notification required.

TSCA 12b

Dicyclopentadiene/ CAS# 77-73-6

TSCA section 4

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Toluene		1000 lbs
Xylene		100 lbs
Ethyl Benzene		1000 lbs
Naphthalene		100 lbs
Isoprene		100 lbs
Benzene		10 lbs
Styrene		1000 lbs
Cumene		5000 lbs
Toluene		1000 lbs
Xylene		100 lbs
Ethyl Benzene		1000 lbs
Naphthalene		100 lbs
Isoprene		100 lbs
Benzene		10 lbs
Styrene		1000 lbs
Cumene		5000 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

<u>Component</u>	<u>Reporting Threshold</u>
Toluene	1.0%
Xylene	1.0%
Ethyl Benzene	0.1%
Naphthalene	0.1%
Benzene	0.1%
Styrene	0.1%
Cumene	1.0%



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

Dicyclopentadiene	1.0%
1,2,4-Trimethylbenzene	1.0%
Toluene	1.0%
Xylene	1.0%
Ethyl Benzene	0.1%
Naphthalene	0.1%
Benzene	0.1%
Styrene	0.1%
Cumene	1.0%
Dicyclopentadiene	1.0%
1,2,4-Trimethylbenzene	1.0%

State Reporting

Known to the State of California to cause cancer.

100-41-4	Ethyl Benzene	(December 11, 2009)
91-20-3	Naphthalene	
78-79-5	Isoprene	
71-43-2	Benzene	
98-82-8	Cumene	(June 14, 2010)
100-41-4	Ethyl Benzene	(December 11, 2009)
91-20-3	Naphthalene	
78-79-5	Isoprene	
71-43-2	Benzene	
98-82-8	Cumene	(June 14, 2010)

Known to the State of California to cause birth defects.

108-88-3	Toluene	(December 11, 2009)
71-43-2	Benzene	
108-88-3	Toluene	
71-43-2	Benzene	

Known to the State of California to cause reproductive toxicity in males.

71-43-2	Benzene	(December 11, 2009)
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Known to the State of California to cause reproductive toxicity in females.

108-88-3	Toluene	(December 11, 2009)
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This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

108-88-3	Toluene
1330-20-7	Xylene
100-41-4	Ethyl Benzene
78-78-4	Isopentane
109-66-0	n-Pentane
287-92-3	Cyclopentane
91-20-3	Naphthalene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

78-79-5	Isoprene
25550-14-5	Ethyl Toluene
95-13-6	Indene
142-82-5	n-Heptane
71-43-2	Benzene
100-42-5	Styrene
103-65-1	Propyl Benzene
98-82-8	Cumene
25551-13-7	Trimethyl benzene
77-73-6	Dicyclopentadiene
111-65-9	N-Octane
25013-15-4	Vinyl toluene
95-63-6	1,2,4-Trimethylbenzene
108-88-3	Toluene
1330-20-7	Xylene
100-41-4	Ethyl Benzene
78-78-4	Isopentane
109-66-0	n-Pentane
287-92-3	Cyclopentane
91-20-3	Naphthalene
78-79-5	Isoprene
25550-14-5	Ethyl Toluene
95-13-6	Indene
142-82-5	n-Heptane
71-43-2	Benzene
100-42-5	Styrene
103-65-1	Propyl Benzene
98-82-8	Cumene
25551-13-7	Trimethyl benzene
77-73-6	Dicyclopentadiene
111-65-9	N-Octane
25013-15-4	Vinyl toluene
95-63-6	1,2,4-Trimethylbenzene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

108-88-3	Toluene
1330-20-7	Xylene
100-41-4	Ethyl Benzene
78-78-4	Isopentane
109-66-0	n-Pentane
287-92-3	Cyclopentane
91-20-3	Naphthalene
78-79-5	Isoprene
95-13-6	Indene
142-82-5	n-Heptane



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

71-43-2	Benzene
100-42-5	Styrene
103-65-1	Propyl Benzene
98-82-8	Cumene
25551-13-7	Trimethyl benzene
77-73-6	Dicyclopentadiene
111-65-9	N-Octane
25013-15-4	Vinyl toluene
95-63-6	1,2,4-Trimethylbenzene
108-88-3	Toluene
1330-20-7	Xylene
100-41-4	Ethyl Benzene
78-78-4	Isopentane
109-66-0	n-Pentane
287-92-3	Cyclopentane
91-20-3	Naphthalene
78-79-5	Isoprene
95-13-6	Indene
142-82-5	n-Heptane
71-43-2	Benzene
100-42-5	Styrene
103-65-1	Propyl Benzene
98-82-8	Cumene
25551-13-7	Trimethyl benzene
77-73-6	Dicyclopentadiene
111-65-9	N-Octane
25013-15-4	Vinyl toluene
95-63-6	1,2,4-Trimethylbenzene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

108-88-3	Toluene
1330-20-7	Xylene
100-41-4	Ethyl Benzene
78-78-4	Isopentane
109-66-0	n-Pentane
287-92-3	Cyclopentane
91-20-3	Naphthalene
78-79-5	Isoprene
95-13-6	Indene
142-82-5	n-Heptane
71-43-2	Benzene
100-42-5	Styrene
103-65-1	Propyl Benzene
98-82-8	Cumene
25551-13-7	Trimethyl benzene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
 Variant: U.S.A.-EN
 Revision: 1.0
 Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

77-73-6	Dicyclopentadiene
111-65-9	N-Octane
25013-15-4	Vinyl toluene
95-63-6	1,2,4-Trimethylbenzene
108-88-3	Toluene
1330-20-7	Xylene
100-41-4	Ethyl Benzene
78-78-4	Isopentane
109-66-0	n-Pentane
287-92-3	Cyclopentane
91-20-3	Naphthalene
78-79-5	Isoprene
95-13-6	Indene
142-82-5	n-Heptane
71-43-2	Benzene
100-42-5	Styrene
103-65-1	Propyl Benzene
98-82-8	Cumene
25551-13-7	Trimethyl benzene
77-73-6	Dicyclopentadiene
111-65-9	N-Octane
25013-15-4	Vinyl toluene
95-63-6	1,2,4-Trimethylbenzene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Revised Section(s): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 May 2011

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations



MATERIAL SAFETY DATA SHEET

MSDS No.: BE172
Variant: U.S.A.-EN
Revision: 1.0
Validation Date: 05/20/2011

HEAVY PYROLYSIS GASOLINE

This document may be available in languages other than English.

End of Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

AP7594

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: BENZENE

Number: 00000000000016113

Chemical characterization: C6 Aromatic Hydrocarbon

CAS-No.: 71-43-2

Chemical Name: Benzene

Synonyms: Benzene, Benzol, Cyclohexatriene, BZ;Benzol;Benzolene;Pyrobenzol:phene;Phenylhydride;Annulene; Cyclohexatriene; Coal Naphtha; Mineral Naphtha; C6 Alkylbenzene; C6 Aromatic Hydrocarbon Solvent; Reagent-grade Benzene (meets ASTM D835" Refined Benzene-485" or "Nitration Grade" Specifications).

Use category: Chemical intermediaries.

Company Address

Houston Refining
 One Houston Center, Suite 700
 1221 McKinney St.
 P.O. Box 2583
 Houston Texas 77252-2583

Company Telephone

Product Safety 800 700-0946
 product.safety@lyondellbasell.com

Emergency telephone

CHEMTREC USA 800-424-9300
 LYONDELL 800-245-4532

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is HAZARDOUS by OSHA Hazard Communication definition.

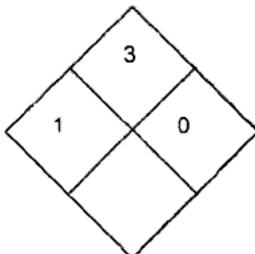
Signal Word

Danger

Hazards

Flammable. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Vapors explosion hazard indoors, outdoors or in sewers. Severe eye irritant. May cause corneal injury and possible necrosis. Skin irritant - defatting action. Respiratory tract irritant. Inhalation hazard. High ingestion hazard-chemical pneumonia. Aspiration hazard. CNS depressant. Cancer Hazard.

NFPA®



HMIS®

Health	*	2
Flammability		3
Physical Hazard		0

Physical state

liquid

Color



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Color

Clear, colorless.

Odor

Distinctive odor. Aromatic odor.

Odor Threshold

1.5 - 5.0 ppm / ODOR IS NOT AN ADEQUATE WARNING TO PREVENT EXPOSURE.

Potential health effects

Routes of exposure

Eye. Inhalation. Skin.

Acute effects

See component summary.

- *Benzene 71-43-2*

Slight acute toxicity. Inhalation exposure to high concentrations may cause dizziness and CNS depression. Ingestion of relatively small amounts may be fatal if aspiration into the lungs takes place.

- *Toluene 108-88-3*

Toluene is of slight acute toxicity, although inhalation exposure may cause dizziness and CNS depression, while ingestion may be fatal if aspiration into the lung occurs. Toluene may increase the sensitivity of the heart leading to potentially fatal cardiac sensitization. It is moderately irritating to skin and eye.

Skin

Irritating to the skin, not a sensitizer. Causes irritation seen as local redness and possible swelling. Not expected to be a skin absorption hazard.

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Eyes

Severe eye irritant.

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death).

Chronic effects

See component summary.

- *Benzene 71-43-2*

Benzene is considered to be a cancer-causing agent. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts and decreased immunological function irrespective of the route of contact.

- *Toluene 108-88-3*

Repeated exposure to high concentrations has been shown to cause neurological changes and hearing loss in animals, and in humans in abuse situations. May cause developmental toxicity.

Aggravated Medical Condition

Individuals with pre-existing skin disorders, kidney, liver, central nervous system, blood and hemopoietic-organ disorders should avoid exposure to this material. Pre-existing disorders of the respiratory system. Any pre-existing disorders or diseases of the eye.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS-No.</u>	<u>EC-No.</u>	<u>Weight %</u>
Benzene	71-43-2	200-753-7	>= 99.7
Toluene	108-88-3	203-625-9	<= 0.1

Typical composition

4. FIRST AID MEASURES

General advice

Benzene is an OSHA regulated substance, depending on the level of exposure, additional medical follow-up may be required. See 29 CFR 1910.1028 (j)(4) for medical requirements due to an emergency situation. Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Take off contaminated clothing and wash before reuse. Clothing that has become saturated with the product must be removed immediately because the product is absorbed through the skin. Seek medical attention if ill effect or irritation develops. After contact with skin, wash immediately with plenty of soap and water.

Inhalation

If overcome by exposure, remove victim to fresh air immediately. Give oxygen or artificial respiration as needed. Obtain emergency medical attention.

Eyes

In case of eye contact, immediately rinse with clean water for 20-30 minutes. Obtain emergency medical attention.

Ingestion

Do not induce vomiting. Risk of damage to lungs exceeds poisoning risk. Seek medical attention if discomfort persists.

5. FIRE-FIGHTING MEASURES

Flammable properties

Classification

OSHA/NFPA Class IB Flammable Liquid.

Flash point

-11 °C (12.2 °F) (TCC)

Autoignition temperature

498 °C (928.4 °F) (ASTM E659).

Lower explosion limit

~ 1.3 vol%

Upper explosion limit

~ 8 vol%



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Extinguishing Media

Suitable extinguishing media

SMALL FIRE: Use dry chemical, CO₂, water spray or regular foam. LARGE FIRE: Use water spray, water fog or regular foam. Do not use straight streams.

Protective equipment and precautions for firefighters

Protective equipment and precautions for firefighters

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Precautions for fire-fighting

Extremely flammable vapors may be generated by material (flash point < freezing point) below normal ambient temperatures. Fine sprays/mists may be combustible at temperatures below normal flash point. Vapors may travel long distances along the ground before reaching a source of ignition and flashing back. A concentration of 2000 ppm in air is immediately dangerous to life/health. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Apply water spray/fog for cooling. Do not use solid water stream/may spread fire. Move containers from fire area if you can do it without risk. Blanket with firefighting foam. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Heat may build enough pressure to rupture closed containers/spreading fire/increasing risk of burns/injuries. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. This material releases flammable vapors at well below ambient temperatures and may form flammable mixtures with air. When mixed with air in certain proportions and exposed to an ignition source, these vapors can burn in the open or be explosive in confined spaces. Being heavier than air, these vapors may travel long distances along the ground before reaching a point of ignition and flashing back.

Hazardous combustion products

Incomplete combustion will form carbon monoxide and other toxic vapors.

6. ACCIDENTAL RELEASE MEASURES

Spills and leaks

Extremely flammable liquid. Release can cause fire/explosion/health/environmental hazards. Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). For larger spillages on water contain with booms or barriers, use surface acting agents to thicken spilled materials. Remove trapped material with suction hoses.

Both local exhaust and good general room ventilation must be provided not only to control exposure but also to prevent formation of flammable mixtures. Special attention should be given to low areas/pits where flammable vapors can accumulate.

7. HANDLING AND STORAGE

Handling

For industrial use only. Use only non-sparking tools. Carefully vent any internal pressure before removing closure. Do not overfill containers which may burst on freezing. Thaw frozen containers only at room temperature. Containers must be properly grounded before beginning transfer. All equipment must conform to applicable electrical code. Handle used containers with care - residue is flammable/poisonous. Isolate, vent, drain, wash and purge systems or equipment before maintenance or repair. Extinguish all ignition sources. Check atmosphere for explosiveness and oxygen deficiencies. If any residual product may be present, total encapsulating impervious protective suits, gloves, and boots should be worn. Observe precautions pertaining to confined space entry. Provide grounding/equipment conforming to electrical codes. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Storage

Store in tightly closed/properly vented containers away from heat/sparks/open flame and strong oxidizing agents. Store closed drums with bung in up position. Avoid breathing vapors in top of shipping container; may contain a known human carcinogen. Bonding and grounding measures may not be enough if nonconductive flammable liquids are involved. Refer to NFPA 77 for relevant consensus guidance.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Both local exhaust and good general room ventilation must be provided not only to control exposure but also to prevent formation of flammable mixtures. Special attention should be given to low areas/pits where flammable vapors can accumulate.

Personal protective equipment

Inhalation

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Skin

Use chemical resistant gloves appropriate to conditions of use. Protective clothing including gloves, apron, sleeves, boots, and full head/face protection should be worn. The equipment must be cleaned thoroughly after each use.

Eyes

Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid, airborne particles, or vapor.

Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. The U.S.Code of Federal Regulations (CFR), 29 CFR 1910.1028, gives detailed information on Benzene health hazards and symptoms of over-exposure. It also addresses the requirements and responsibilities for providing, wearing, and maintaining protective equipment as well as procedures for medical monitoring of Benzene exposures. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Take off contaminated clothing and wash before reuse. Shower after work using plenty of soap and water.

Occupational Exposure Limits

Component	Source	Type:	Value	Note
Benzene	US (ACGIH)	STEL	2.5 ppm	None.
	US (ACGIH)	TWA	0.5 ppm	None.
	98/24/EC	Peak	50 ppm	None.
	US (OSHA)	CEILING	25 ppm	None.
	US (OSHA)	STEL	5 ppm	None.
	US (OSHA)	TWA	10 ppm	None.
	US (OSHA)	TWA	1 ppm	None.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Toluene	NIOSH	IDLH	500 ppm	None.
	US (ACGIH)	TWA	20 ppm	None.
	98/24/EC	Peak	500 ppm	None.
	US (OSHA)	CEILING	300 ppm	None.
	US (OSHA)	TWA	200 ppm	None.
	NIOSH	IDLH	500 ppm	None.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: liquid Clear, colorless.

Odor: Distinctive odor. Aromatic odor.

Odor Threshold: 1.5 - 5.0 ppm ODOR IS NOT AN ADEQUATE WARNING TO PREVENT EXPOSURE.

pH: Not applicable.

Boiling point/boiling range: ~ 80 °C (176 °F)

Melting/freezing point: ~ 5.5 °C (41.9 °F)

Flash point: -11 °C (12.2 °F) (TCC)

Autoignition temperature: 498 °C (928.4 °F) (ASTM E659).

Flammability: OSHA/NFPA Class IB Flammable Liquid.

Lower explosion limit: ~ 1.3 vol%

Upper explosion limit: ~ 8 vol%

Explosive properties: No Data Available. No Data Available.

Oxidizing properties: No Data Available. No Data Available.

Vapor pressure: ~ 75 mm Hg @ 20 °C (68 °F)

Evaporation rate: 2.8 (ether = 1)

Relative density: 0.879 @ 20 °C (68 °F) (Water = 1)

Relative vapor density: ~ 2.8 @ 15 - 20 °C (59 - 68 °F)(Air = 1.0)

Viscosity: 0.604 mPa.s @ 25 °C (77 °F)

Water solubility: slightly soluble

Partition coefficient: n-octanol/water: Log Kow = 2.13



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Other physico-chemical properties: Refractive index N20/D = 1.5011.

10. STABILITY AND REACTIVITY

Chemical stability

The product is stable.

Conditions to avoid

Heat, sparks, open flame, other ignition sources, oxidizing conditions, and freezing temperatures.

Materials to avoid

Nitric acid. Halogens (bromine, chlorine, fluorine). Strong oxidizing agents.

Hazardous decomposition products

Excessive heating and/or incomplete combustion may produce carbon monoxide, carbon dioxide and other harmful substances.

Hazardous polymerization

Not expected to occur.

Reactions with Air and Water

Not expected to occur.

11. TOXICOLOGICAL INFORMATION

Product information

Product Summary

Benzene is of slight acute toxicity, although inhalation exposure to high concentrations may cause dizziness and CNS depression, while ingestion of relatively small amounts may be fatal if aspiration into the lung takes place. Liquid benzene is irritating to skin and severely irritating to the eye. Repeated exposure is linked to bone marrow toxicity, reduced red- and white blood cell counts, and decreased immunological function irrespective of the route of contact. It is a multi-site carcinogen in animals, while human epidemiology studies demonstrate a causal association between long term occupation exposure and acute non-lymphocytic leukemia. It is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rodents following oral or inhalation exposure. Results from reproductive studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. Mild fetotoxicity (lowered fetal body weight, delayed ossification and sub-clinical hematological changes, generally in association with maternal toxicity) has been observed in rats and mice exposed during pregnancy. The relevance of these changes to human reproductive health is not known.

COMPONENT INFORMATION

- Benzene 71-43-2

Acute toxicity

<u>LC50 (vapor)</u>	rat	13,700 PPM	4 HOURS
	mouse	9980	8 HOURS
	rat	10000	7 HOURS

<u>LD50 (Skin)</u>	rabbit	> 8260 MG/KG BWT
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MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Acute effects

Inhalation

Signs of eye, throat, and respiratory tract irritation (cough and difficulty breathing), CNS depression (fatigue, dizziness, headache, collapse, coma and death) and possible cardiac sensitization may occur after exposure to high vapor concentrations.

Ingestion

May cause CNS depression, gastric discomfort, and vomiting. This material is an aspiration hazard.

Skin contact

No systemic toxicity is expected from acute dermal exposure.

Irritation

Skin

Skin irritant.

Eyes

Severe eye irritant.

Sensitization

No evidence of skin or respiratory sensitization.

Target Organs

Damages bone marrow. Eye. Skin.

Repeated dose toxicity

The hematopoietic system is the primary target for benzene, irrespective of the route of exposure. Broadly similar effects are seen in rodents and humans, including bone marrow toxicity and reduced red- and white blood cell counts.

Reproductive effects

Results from animal studies are inconsistent, with adverse effects on the ovary and testis reported in mice following repeated inhalation exposure but no effects on the gonads or on fertility observed in rats exposed under similar conditions. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Developmental Toxicity

Results from animal studies clearly demonstrate that benzene is not a teratogen, however mild fetotoxicity (including lowered body weight, delayed ossification and sub-clinical hematological changes) have been observed in rodents exposed during pregnancy, generally in association with maternal toxicity. No reliable human data are available, hence the relevance of these findings to human reproductive health is not known.

Genetic Toxicity

Benzene is genotoxic in vivo, and induces chromosomal aberrations and micronuclei in rats and mice following oral or inhalation exposure. Comparable changes would be anticipated in humans. The incidence of micronuclei in fetal rat liver is increased following administration of large doses by intraperitoneal injection to pregnant mice, while high-level oral exposure induced chromosomal aberrations in germ cells from male mice. The relevance to humans of these latter findings is not known.

Carcinogenicity

Benzene is a multi-site animal carcinogen, producing tumors in hematopoietic- and epithelial tissues after long term inhalation or oral exposure. Epidemiology studies confirm it is a human carcinogen, causing primarily acute non-lymphocytic leukemia.

- *Toluene 108-88-3*

Acute toxicity

<u>LC50 (vapor)</u>	rat	7500 PPM	4 HOURS
	rat	5,580 MG/KG BWT	
	Rabbit.	> 5000 MG/KG BWT	

Acute effects

Inhalation



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Vapors or aerosol may cause irritation of the eyes, nose and throat as well as CNS depression (fatigue, dizziness, loss of concentration, with collapse, coma and death possible in cases of severe overexposure).

Ingestion

Ingestion may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness, collapse, coma and death). May increase the sensitivity of the heart to endogenous catecholamines leading to potentially fatal cardiac sensitization.

Skin contact

Repeated contact with skin may cause cracking and/or fissuring.

Irritation

Skin

Moderate skin irritant.

Eyes

Moderate eye irritant.

Sensitization

Not expected to cause sensitization by skin contact.

Target Organs

Skin. Eye. Hearing. Nasal cavity. central nervous system (CNS) Heart

Repeated dose toxicity

No evidence of systemic toxicity was reported in rats exposed to 1.15 mg/l (300 ppm) toluene vapor for two years, while higher exposures were associated with inflammation and degeneration of nasal epithelial tissue. Rats exposed repeatedly to very high concentrations of toluene exhibited neurological changes and permanent hearing loss. Clinical case reports indicate the occurrence of serious and persistent changes (including tremor, ataxia, memory impairment and possible hearing loss) in humans following deliberate over-exposure to toluene in abuse situations. The relevance of these findings to low level occupational exposure to toluene is not known.

Reproductive effects

Studies in animals demonstrate no histopathological lesions in testes or ovaries of rats and mice exposed to 9.4 mg/l (2500 ppm) toluene vapor for 14-15 weeks, and no loss of fertility in male rats after exposure to 7.5 mg/l (2000 ppm) for a similar period of time. Epididymal weights and sperm counts were decreased in one study, but the absence of any adverse effect on reproduction makes the functional relevance of these observations unclear. No reliable human data are available.

Developmental Toxicity

Studies in pregnant rats demonstrate that toluene is not a teratogen, however mild fetotoxicity (lower body weight, delayed ossification, delayed physical development) may occur in the absence of maternal toxicity at exposures in the range 1.9-2.8 mg/l (500-750 ppm). Other studies describe adverse effects on learning and cognitive functions in rat pups exposed to 4.5-6.7 mg/l (1200-1800 ppm) in utero, although it is unclear if end-points evaluated in these tests are directly relevant to humans.

Genetic Toxicity

In vitro and in vivo mutagenicity tests were negative.

Carcinogenicity

Inhalation studies in rats and mice demonstrate that toluene is not a carcinogen. It has been used extensively as a solvent in rodent skin painting studies with occasional slight, increases in tumor incidence reported: an epigenetic mechanism (based on irritation rather than genotoxicity) may underpin these findings. Toluene is considered a Group 3 substance by IARC, not classifiable as to its carcinogenicity to humans.

12. ECOLOGICAL INFORMATION

Product information

Ecotoxicity

See component summary.



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Environmental fate and pathways

See component summary.

COMPONENT INFORMATION

- *Benzene* 71-43-2

Ecotoxicity

Acute Fish toxicity

LC50 / 96 HOUR *Oncorhynchus mykiss* 5.3 - 21.6 mg/l

LC50 / 96 HOUR *Pimephales promelas* 14.0 - 15.6 mg/l

LC50 / 96 HOUR *Poecilia reticulata* 28.6 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 24 HOURS *Daphnia magna*. 10 mg/l

EC50 / 48 HOUR *Ceriodaphnia dubia* 17.2 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR *Selenastrum capricornutum* 28 - 100 mg/l

Toxicity to microorganisms

IC50 / 24 HOURS *Nitrosomonas* sp. 13 mg/l

Chronic toxicity to fish

LOEC / 32 DAY *Pimephales promelas* 1.6 mg/l

Chronic toxicity to aquatic invertebrates

EC50 / 7 DAY *Ceriodaphnia dubia* 11.6 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: When released to water, volatilization will result in substantial losses to the atmosphere with a calculated half-life in the troposphere of approximately 13.4 days. A calculated Koc value of 134.1 l/kg does not indicate a significant potential for bioaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Bioconcentration factor (BCF) ~ 10 (fish.) BCF in fish ~ 10.

- *Toluene* 108-88-3

Ecotoxicity



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Acute Fish toxicity

LC50 / 96 HOUR Oncorhynchus mykiss 55 mg/l

LC50 / 96 HOUR Carassius auratus 22.8 mg/l

LC50 / 96 HOUR Pimephales promelas 31.7 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR Daphnia magna. 11.5 - 14.9 mg/l

Toxicity to aquatic plants

Summary: No Data Available.

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

NOEC / 40 DAY Oncorhynchus sp. 1.4 mg/l

Summary: Actual exposure time: 27 - 40 day.

Chronic toxicity to aquatic invertebrates

NOEC / 21 DAY Daphnia magna. 1.0 mg/l

NOEC / 7 DAY Ceriodaphnia dubia 0.74 mg/l

Environmental fate and pathways

Mobility

Behavior in environmental compartments: The atmosphere is the main environmental compartment for the release of toluene. In water, volatilization will result in substantial losses to the atmosphere with a half-life of 1-2 days. A calculated Koc value of 37-160 indicates no significant potential for geoaccumulation.

Persistence and degradability

Biodegradation: Readily biodegradable in aerobic conditions.

Bioaccumulation: Log Kow (Fish) <3

13. DISPOSAL CONSIDERATIONS

Assure effluent complies with applicable regulations. Landfill solids at permitted sites. Use registered transporters. Burn concentrated liquids. Avoid flame-outs. Assure emissions comply with applicable regulations. Familiarize personnel with proper use of respiratory protection equipment. Avoid waste contact/breathing harmful vapors. Dilute aqueous waste, free of floating oil, may biodegrade. Avoid overloading/poisoning plant biomass. (See 40 U.S. Code of Federal Regulations (CFR) 261 and 29 CFR 1910). Contaminated product/soil/water may be U.S. Resource Conservation and Recovery Act (RCRA)/U.S. Occupational Safety and Health Administration (OSHA) hazardous waste due to potential fire/poisoning.

14. TRANSPORT INFORMATION

Special Provisions

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper shipping name Benzene

Reportable quantity BENZENE



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

ID No. UN1114
 Hazard class 3
 Packing group II

15. REGULATORY INFORMATION

Notification status

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Japan	ENCS/SHL
Korea	ECL
Philippines	PICCS
United States of America	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

If identified components of this product are listed under the TSCA 12(b) Export Notification rule, they will be listed below.

SARA 302/304

<u>Component</u>	<u>TPQ</u>	<u>RQ</u>
Benzene		10 lbs
Toluene		1000 lbs

SARA 311/312

Based upon available information, this material is classified as the following health and/or physical hazards according to Section 311 & 312:

Immediate (Acute) Health Hazard.
 Delayed (Chronic) Health Hazard.
 Fire Hazard.
 Sudden Release of Pressure.

SARA 313

This product contains the following chemicals subject to the reporting requirements of SARA Title III, Section 313 and 40 CFR 372:

<u>Component</u>	<u>Reporting Threshold</u>
Benzene	0.1%
Toluene	1.0%

State Reporting

Known to the State of California to cause cancer.

71-43-2 Benzene (December 11, 2009)

Known to the State of California to cause birth defects.

71-43-2 Benzene (December 11, 2009)

108-88-3 Toluene



MATERIAL SAFETY DATA SHEET

MSDS No.: BE210
 Variant: U.S.A.-EN
 Revision: 1.1
 Validation Date: 11/05/2010

BENZENE

Known to the State of California to cause reproductive toxicity in males.

71-43-2 Benzene (December 11, 2009)

Known to the State of California to cause reproductive toxicity in females.

108-88-3 Toluene (December 11, 2009)

This product contains the following chemicals regulated by New Jersey's Worker and Community Right to Know Act:

71-43-2 Benzene

108-88-3 Toluene

This product contains the following chemicals regulated by Massachusetts' Right to Know Law:

71-43-2 Benzene

108-88-3 Toluene

This product contains the following chemicals regulated by Pennsylvania's Right to Know Act:

71-43-2 Benzene

108-88-3 Toluene

16. OTHER INFORMATION

Material safety datasheet sections which have been updated:

Last revision: Logo change. November 3 2010

Disclaimer

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable. Information is correct to the best of our knowledge at the date of the MSDS publication.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

End of Material Safety Data Sheet



Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0003
Revision Date 10/11/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Compressed Gas/Liquid.
Color Colorless liquid; invisible vapor. **Odor** Odorless to faint, unpleasant.

DANGER! Extremely flammable compressed gas/liquid; vapor may cause flash fire or explosion.
High pressure and rapid diffusion hazard.
High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation.
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats).
Liquid or compressed gas contact may cause frostbite or freeze burns.

Hazard Rankings

	HMIS	NFPA
Health Hazard	2	1
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068814675*	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	68814-67-5 or 68476-01-3	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Hydrogen and C1-C5 Alkane/Alkene Hydrocarbons Mixture		
Synonyms	Demoisturized C1-C4 Hydrocarbons with Hydrogen; Reformer Hydrogen; Reformer Recycle Gas; Reformer Makeup, Hydrogen-rich, Gases (Petroleum); DHDS, NHDS, and 2nd Stage Recycle Gases; 460 Header Hydrogen.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Distillation Tail Gas, Hydrogen Sulfide-Free (Petroleum)	68308-02-1	100
2) Hydrogen	1333-74-0	50-85
3) Methane	74-82-8	5-20
4) Ethane	74-84-0	5-15
5) Ethylene	74-85-1	1-5
6) Propane	74-98-6	1-10
7) Propylene	115-07-1	1-3
8) Iso-Butane	75-28-5	1-3
9) Butenes or Butylenes	25167-67-3	1-3
10) n-Butane	106-97-8	0-2

Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact. Eye contact.

Signs and Symptoms of Acute Exposure

Inhalation	One or more components of this gas mixture are "simple asphyxiants" (see Section 8). Their vapors can displace the amount of oxygen in air available to breathe below that necessary to sustain life, especially if working in confined spaces. Breathing vapors may also irritate the respiratory tract and cause central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, blurred vision, memory loss, drowsiness, fatigue, rapid or difficult breathing, confusion, vertigo, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure.
Eye Contact	This gas is non-irritating; however, direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. This material is not expected to be absorbed through the skin.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus.
Chronic Health Effects Summary	Chronic inhalation exposure or high concentrations of some components of this gas (propane, propylene, isobutane, butenes, and n-butane) of this material may increase the sensitivity of the heart to epinephrine (adrenalin) and catecholamine-like drugs . Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, or cardiovascular conditions should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of "simple asphyxiants". They should take additional precautions to minimize or avoid exposure.
Target Organs	The substance is toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, and heart.
Carcinogenic Potential	This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
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Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is a highly unlikely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.</p> <p>Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse).</p> <p>If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point Method	CLOSED CUP: AP -185°C (-301°F) [Estimated]		
Lower Flammable Limit	AP 2.0%	Upper Flammable Limit	AP 74.2%
Autoignition Temperature	AP 288°C (550°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, unburned hydrocarbon vapors, and possibly trace oxides of sulfur.		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

This gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid, solid, or vapors.

Body Protection Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower.

Respiratory Protection Odor is not an adequate warning for potentially hazardous air concentrations! For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments For an explanation about some of the occupational exposure limits shown below, refer to the definition of "Simple Asphyxiant" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current **Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents** handbook. Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (< 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen	Simple asphyxiant.
2) Methane	Simple asphyxiant.
3) Ethane	Simple asphyxiant.
4) Ethylene	Simple asphyxiant.
5) Propylene	Simple asphyxiant.
6) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL)
7) Butane	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL)
8) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL)

Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Compressed Gas/Liquid.	Color	Colorless liquid; invisible vapor.	Odor	Odorless to faint, unpleasant.
Specific Gravity	0.45 to 0.58 (Water = 1)	pH	Not applicable.	Vapor Density	0.75 to 2.0 (Air = 1)
Boiling Point/Range	-254° to -0.5°C (-425° to 31°F) at 14.7 psia [ASTM D-2887]			Melting/Freezing Point	-240° to -138°C (-400° to -217°F) at 14.7 psia
Vapor Pressure	100 to 250 psia at 40°C (104°F)			Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Slightly soluble in cold water.			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.

Additional Properties This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard.
 Average Density at 60°F = < 4.25 lbs./gallon [ASTM D-2500];
 Gross Heat of Combustion at 60°F = 21,500 to 24,000 Btu/lb. or 1,000 to 2,500 Btu/cu.ft.;
 Dry Point Temperature = 31°F (-0.5°C) [ASTM D-86].

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data	<p>Propylene: GAS (LC₅₀): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse]. GAS (TC_{Lo}): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.</p> <p>Iso-Butane: GAS (TC_{Lo}): Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement. GAS (LC₅₀): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p> <p>Iso-Butene (Isobutylene or 2-Methylpropene): GAS (LC₅₀): Acute: 415 gm/m³ for 2 hours [Mouse]. GAS (LC₅₀): Acute: 620 gm/m³ for 4 hours [Rat].</p> <p>n-Butane:</p>
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Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene

Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

concentrations of 40% or higher for a couple minutes cause redding of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to **propylene** may entail a possible hazard from the formation of a reactive metabolite, **propylene oxide**, which is a "suspect human carcinogen". However, propylene have not been shown to be carcinogenic in rat studies. For example, propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. **Propylene** is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane** and **n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane** and **butylene** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material; however, releases are expected to cause only localized non-persistent environmental damage.

At ambient temperatures and pressure, the **ethylene, propylene, and butenes** components of this material will readily vaporize and may contribute to generation of atmospheric smog. The atmospheric half-lives of **ethane, ethylene, propane, propylene, and the butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours. Experimental data shows that significant photooxidation of **ethylene and propylene** occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **ethane, propane, isobutane, and n-butane** in air (< 8%) are not considered to be environmentally significant.

Environmental Fate

Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (< 0.1%); and therefore, this material will not cause harm to aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Compressed gases, flammable, n.o.s. (Hydrogen, Methane)		
Hazard Class	DOT Class: 2.1 (Flammable gas).	Packing Group(s)	Not applicable.
		UN/NA ID	UN1954
Reportable Quantity	There are no Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display.		
Placards		Emergency Response Guide No.	115
		HAZMAT STCC No.	49 057 29
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances present in this material which are subject to this statute: None were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Acute (Immediate) and Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations above de minimis levels that are listed as "Toxic Chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Ethylene or Ethene [CAS No. 74-85-1] concentration = 1 to 5% Propylene or Propene [CAS No. 115-07-1] concentration = 1 to 3%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This material does not contain any chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
CWA	This material might be classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.

Hydrogen-rich, Sweet Refinery Gases (C1-C4 Hydrocarbons)**Additional Regulatory Remarks**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": **Ethylene (Ethene), Propylene (Propene), 1-Butene, and Isobutylene.**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Hydrogen, Methane, Ethane, Ethylene (Ethene), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), Butane, and various Butenes.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 7.0
Revision Date 10/11/2002
Print Date Printed on 10/15/2002.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Refinery Fuel Gas

Material Safety Data Sheet

LYONDELL-CITGO Refining LP 12000
Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0004
Revision Date 09/10/2001

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquefied Gas		
Color	Colorless liquid, invisible vapor	Odor	Odorless to a strong, foul smelling, rotten egg odor which is unreliable as a warning of possible exposure

DANGER! Extremely flammable and potentially poisonous gas/liquid; vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
Contains low levels of hydrogen sulfide (H₂S)!
May be harmful or fatal if inhaled!
High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation!
Mist or vapor may cause eye, skin, mucous membrane, and respiratory tract irritation and inflammation!
Liquid or compressed gas contact may cause frostbite or freeze burns!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
May be corrosive to some metals!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Refinery Fuel Gas	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068308270*	Medical Emergency	(918) 495-4700
CAS Number	68308-27-0	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Fuel Gas		
Synonyms	Refinery Gas Mixture, Treated Low-pressure (Low-Line) Gas, Desulfurized Fuel Gas, C1-C5 Hydrocarbons and Hydrogen with residual Hydrogen Sulfide, Hydrogen and Alkane/Alkene Hydrocarbons		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Fuel Gases, Refinery	68308-27-0	100
2) Nitrogen	7727-37-9	3-6
3) Hydrogen	1333-74-0	1-10
4) Methane	74-82-8	35-55
5) Ethane	74-84-0	10-20
6) Ethylene	74-85-1	2-4
7) Propane	74-98-6	5-15
8) Propylene	115-07-1	1-3

Refinery Fuel Gas

9) Iso-Butane	75-28-5	2-5
10) Butenes or Butylenes	25167-67-3	1-2
11) n-Butane	106-97-8	2-6
12) Iso-Pentane	78-78-4	1-3
13) n-Pentane	109-66-0	0 5-3
14) Hydrogen sulfide	7783-06-4	0 0001-0 1

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death (See Section 11)</p> <p><i>Additionally, at least one component of this gas/liquid mixture is a "simple asphyxiant". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia) Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces</i></p>
Eye Contact	<p>Vapors may cause moderate to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and duration of exposure. Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn "</p>
Skin Contact	<p>Direct contact with an expanding gas may produce severe and possibly permanent skin damage from frostbite or freeze burns Hydrogen sulfide can be absorbed through the skin to produce toxic effects</p>
Ingestion	<p>Ingestion is not an applicable route of exposure for gases</p>
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures (See Section 11)</p> <p>Chronic inhalation to components of this gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.</p>
Conditions Aggravated by Exposure	<p>Personnel with eye, skin, cardiac, pulmonary, or neurological disorders, high blood pressure, and those with a compromised ability to use oxygen (asthmatics, anemics, etc) should take additional precautions to minimize or avoid exposure</p> <p>Exposure to high concentrations of this material may increase the sensitivity of the heart to epinephrine (adrenalin) and catecholamine-like drugs. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians")</p>
Target Organs	<p>The substance is toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, and possibly, the endocrine and reproductive systems</p>
Carcinogenic Potential	<p>This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP</p>

Refinery Fuel Gas

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. If pain, redness, swelling, tearing, or light sensitivity persists, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Flammable Gas/Liquefied Gas Extremely flammable ¹		
Flash Point Method	CLOSED CUP AP -107° to -73°C (-160° to -100°F) (Estimated)		
Lower Flammable Limit	AP 1.6 %	Upper Flammable Limit	AP 45 %
Autoignition Temperature	AP 260°C (500°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur		
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources ¹ . Hydrogen burns with a blue flame which may not be visible in daylight.		

Refinery Fuel Gas

Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas/Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safely stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling **Danger! Poisonous and Flammable Gas!** Do NOT breathe vapor, it contains **hydrogen sulfide (H₂S)**. This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Refinery Fuel Gas

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N F P A 's National Electrical Code (NEC). H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Avoid skin contact and use gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection.

Respiratory Protection

A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this gas may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Odor is an inadequate warning for hazardous air concentrations. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Refinery Fuel Gas

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA 10 STEL 15 (ppm) from ACGIH (TLV) TWA 5 (ppm) from ACGIH (TLV) [Proposed] TWA 10 STEL 15 CEIL 20 (ppm) from OSHA (PEL)
2) Hydrogen	Simple asphyxiant
3) Methane	Simple asphyxiant
4) Ethane	Simple asphyxiant
5) Ethylene	Simple asphyxiant
6) Propylene	Simple asphyxiant
7) Liquefied Petroleum Gases	TWA 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL)
8) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA 1000 (ppm) from OSHA (PEL)
9) Butanes	TWA 800 (ppm) from ACGIH (TLV) TWA 800 (ppm) from OSHA (PEL)
10) Pentane, all isomers	TWA 600 (ppm) from ACGIH (TLV) TWA 1000 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas	Color	Colorless liquid, invisible vapor.	Odor	Odorless to a strong, foul smelling, rotten egg odor which is unreliable as a warning of possible exposure
Specific Gravity	AP 0.37 to 0.58 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to acidic H ₂ SO ₄	Vapor Density	1.0 to 2.0 (Air = 1)
Boiling Point/Range	-253° to 35°C (-423° to 96°F) (by ASTM D-2887)	Melting/Freezing Point	AP -260° to -82°C (-435° to -117°F) at 14.7 psia	Viscosity (cSt @ 40°C)	Not applicable
Vapor Pressure	50 to 250 psia at 100°F	Volatile Characteristics	This material is usually stored as a liquefied gas mixture. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.		
Solubility in Water	Moderately soluble in cold water (GT 0.5%)				
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Alkane, Isoparaffin, Alkene, and Cycloalkane Hydrocarbons Content = GT 99.9 Wt % (ASTM D-1319), Hydrogen Sulfide Content = 0.0001 to 0.1 Wt %, Average Density at 60°F = LT 4.50 lbs/gal (ASTM D-2161); Gross Heat of Combustion at 60°F = AP 21,000 Btu/lb or 900 to 2,500 Btu/cu ft				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

Refinery Fuel Gas

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen sulfide:

- GAS (TCLo) Acute 10 ppm for 15 minutes (Human) - Eye irritation
- GAS (TCLo) Acute 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation
- GAS (LC100) Acute 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death
- GAS (LCLo) Acute 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death

Propylene:

- GAS (LC50) Chronic 1,250 ppm for 6 hours/day for 14 weeks [Mouse]
- GAS (TCLo) Chronic 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response

Iso-Butane:

- GAS (TCLo) Acute 1,040 gm/m³ for 2 hours [Mouse] - Excitement
- GAS (LC50) Acute 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

n-Butane:

- GAS (LC50) Acute 660 gm/m³ for 4 hour(s) [Rat]
- GAS (LC50) Acute 680 gm/m³ for 2 hours [Mouse]

2,2-Dimethylpropane (Neopentane):

- INTRAPERITONEAL (LD50) Acute 100 mg/kg [Mouse]

n-Pentane:

- GAS (LC50) Acute 364 gm/m³ for 4 hour(s) [Rat] - Excitement
- INTRAVENOUS (LD50) Acute 446 mg/kg [Mouse]

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol % in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred, however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects, however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Refinery Fuel Gas

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage, however, at ambient temperatures and pressure, the ethylene, propylene, butenes, and hydrogen sulfide components of this material may contribute to generation of atmospheric smog. The atmospheric half-lives of ethane, propane, and butanes under photochemical smog conditions are estimated to be between 5 to 8 hours, and, experimental data shows that significant photooxidation of ethylene and propylene occurs rapidly within 14 to 21 hours. The atmospheric half-lives of butanes under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of hydrogen, methane, ethane, propane, isobutane, and n-butane in air (LT 8%) are not considered environmentally significant. The n-pentane and pentane isomers all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.
Environmental Fate	Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%), and therefore, this material will not cause harm to aquatic life. For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation (DOT) regulated material		
Proper Shipping Name	Compressed gases, toxic, flammable, n.o.s. (Hydrogen sulfide, Methane) Inhalation Hazard Zone B		
Hazard Class	2.3 (Poison gas) and 2.1 (Flammable gas)	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	A Reportable Quantity (RQ) has been established for the Hydrogen sulfide component of this material. (See Section 15.)		
Placards			Emergency Response Guide No. 119
		HAZMAT STCC No.	49 057 66
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

Refinery Fuel Gas

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance present in this material which is subject to this statute is: Hydrogen sulfide [CAS No. 7783-06-4] concentration: 0.0001 to 0.1 Wt. %.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Reactive Hazard, Sudden Release of Pressure Hazard, and the Acute (Immediate) and Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations above de minimis levels and they are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 Ethylene or Ethene [CAS No. 74-85-1] concentration: 2 to 4 Wt. % Propylene or Propene [CAS No. 115-07-1] concentration: 1 to 3 Wt. %.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance present in this material subject to this statute is Hydrogen sulfide (RQ = 100 lbs. [45.36 kg]) concentration = 0.0001 to 0.1 Wt. %.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution and endanger public health and welfare" Ethylene (Ethene) [CAS No. 74-85-1], Propylene (Propene) [CAS No. 115-07-1], 1-Butene [CAS No. 106-98-9], Isobutylene [CAS No. 115-11-7], Isopentane [CAS No. 78-78-4], and n-Pentane [CAS No. 109-66-0]. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: Hydrogen, Methane, Ethane, Ethylene (Ethene), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), Butenes, Butane, Isopentane (Butane, 2-methyl), Pentane, and Hydrogen Sulfide.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	6.0
Revision Date	09/10/2001
Print Date	Printed on 09/10/2001

Refinery Fuel Gas**ABBREVIATIONS**

AP = Approximately EQ = Equal > = Greater Than < = Less Than NA = Not Applicable ND = No Data NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association
IARC = International Agency for Research on Cancer NTP = National Toxicology Program
NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration
NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System
NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL. AN MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Methane/Hydrogen-rich, Sweet Refinery Gases (C1-C5 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0005
Revision Date 06/12/2000

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquefied Gas
Color Colorless liquid; invisible gas and vapor, white frost at release point. **Odor** Faint, unpleasant.

DANGER! High pressure and rapid diffusion hazard!
Extremely flammable gas/liquid; vapor may cause flash fire or explosion!
High concentrations of vapor reduce oxygen available for breathing!
May cause central nervous system (CNS) depression or suffocation!
Liquid or compressed gas contact may cause frostbite or freeze burns!
Vapor or mist may irritate mucous membranes and respiratory tract!
Liquid contact may cause mild to moderate eye and/or skin irritation!
May be harmful or fatal if inhaled or absorbed through the skin!
Overexposures may cause target organ effects such as lung, brain, liver, and/or kidney damage!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!

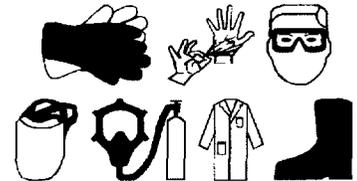
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Methane/Hydrogen-rich, Sweet Refinery Gases (C1-C5 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068308270*	Medical Emergency	(918) 495-4700
CAS Number	68308-27-0	CHEMTREC Emergency	(800) 424-9300
Product Family	C1-C5 Alkane and Alkene Hydrocarbons with Hydrogen		
Synonyms	Sweet Refinery Gas; Light Ends Fractionation Gases, DEA Contactor Tail Gases, Stabilizer Off Gases; Light Reformate Stabilizer Tower Overhead Gas Stream; Distillation Tail Gases, Hydrogen Sulfide-free (Petroleum), C1-C5 Hydrocarbons and Hydrogen Mixture.		

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Distillation Tail Gas, Hydrogen Sulfide-Free (Petroleum)	68308-02-1	100
2) Methane	74-82-8	25-40
3) Hydrogen	1333-74-0	15-30
4) Ethane	74-84-0	10-20
5) Ethylene	74-85-1	1-5
6) Propane	74-98-6	5-15
7) Propylene	115-07-1	1-5
8) Iso-Butane	75-28-5	1-5
9) Butenes or Butylenes	25167-67-3	1-3
10) n-Butane	106-97-8	1-5
11) Iso-Pentane	78-78-4	1-3
12) n-Pentane	109-66-0	0.5-1.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact Eye contact

Signs and Symptoms of Acute Exposure

Inhalation	Several components of this gas/liquid mixture are "simple asphyxiants" (see Section 8) High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (<i>hypoxia</i>), especially if working in confined spaces Breathing vapors may also cause central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure
Eye Contact	Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Prolonged or repeated vapor exposure may cause irritation. This is based upon animal test results for this product's heavier components.
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. The liquid form may cause mild to moderate skin irritation and inflammation
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus or be aspirated into the lungs Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death
Chronic Health Effects Summary	Chronic inhalation to components of this liquefied gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline) -like drugs.
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.
Target Organs	This substance is toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, and possibly, the liver and/or kidneys
Carcinogenic Potential	This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines and other sympathomimetic drugs such as epinephrine (adrenaline) should be reserved for emergency situations and then used only with special precaution.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point Method	CLOSED CUP LT -60°C (-76°F) (Estimated)		
Lower Flammable Limit	AP 1.4%	Upper Flammable Limit	AP 12.5%
Autoignition Temperature	AP 288°C (550°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, unburned hydrocarbons, and oxides of sulfur.		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Some components are lighter than air and rise rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, this material will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources!		

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

Extinguishing Media

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials

Fire Fighting Protective Clothing

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802)

SECTION 7: HANDLING AND STORAGE**Handling**

This liquefied gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier Do not puncture or incinerate cylinders

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection Ensure that an emergency eye wash station and safety shower are near the work-station location

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment For certain operations, additional PPE may be required.

**Eye Protection**

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gases If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

For an explanation about some of the occupational exposure limits shown below, refer to the definition of "Simple Asphyxiant" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current **Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents** handbook Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability Warning! Odor is an inadequate warning for hazardous conditions

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen	Simple asphyxiant
2) Methane	Simple asphyxiant.
3) Ethane	Simple asphyxiant
4) Ethylene	Simple asphyxiant.
5) Propylene	Simple asphyxiant.
6) Propane	TWA: 2500 (ppm) from ACGIH (TLV) [1999] TWA: 1000 (ppm) from OSHA (PEL) [1989]
7) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1999] TWA: 800 (ppm) from OSHA (PEL) [1989]
8) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) [1999] TWA: 1000 (ppm) from OSHA (PEL) [1976]
9) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1999] TWA: 1000 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible gas and vapor, white frost at release point	Odor	Faint, unpleasant.
Specific Gravity	0.40 to 0.53 (Water = 1)	pH	Not applicable.	Vapor Density	0.5 to 1.0 (Air = 1)
Boiling Point/Range	-253° to 36°C (-423° to 97°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			-260° to -129°C (-435° to -200°F) at 14.7 psia
Vapor Pressure	100 to 205 psia at 40°C (104°F)	Viscosity (cSt @ 40°C)			Not applicable.
Solubility in Water	Slightly soluble in cold water.	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 22,000 to 25,000 Btu/lb or 1,000 to 2,000 Btu/cu.ft ; Dry Point Temperature = AP 82°F (28°C) (ASTM D-86), Average Density at 60°F = LT 5.0 lbs./gal (ASTM D-2161).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur, but possible.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Propylene:

GAS (LC50): Chronic. 1,250 ppm for 6 hours/day for 14 weeks [Mouse]

GAS (TCLo): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response

Iso-Butane:

GAS (TCLo) Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement

GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

Iso-Butene (Isobutylene or 2-Methylpropene)

GAS (LC50): Acute: 415 gm/m³ for 2 hours [Mouse].

GAS (LC50): Acute: 620 gm/m³ for 4 hours [Rat] **n-Butane**

GAS (LC50): Acute: 658,000 mg/m³ for 4 hours [Rat].

GAS (LC50) Acute. 680,000 mg/m³ for 2 hours [Mouse].

n-Butane

GAS (LC50). Acute 658,000 mg/m³ for 4 hours [Rat].

GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse].

n-Pentane

GAS (LC50): Acute. 364,000 mg/m³ for 4 hours [Rat] - Excitement

INTRAVENOUS (LD50): Acute: 446 mg/kg [Mouse].

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to **propylene** may entail a possible hazard from the formation of a reactive metabolite, **propylene oxide**, which is a "suspect human carcinogen". However, propylene have not been shown to be carcinogenic in rat studies. For example, propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. **Propylene** is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane** and **n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane** and **butenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

Inhalation of 500 ppm of **isopentane** or **n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9 to 12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be be fatal. n-Pentane caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure. Rat 28-day feeding studies on both isopentane and n-pentane using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the ethylene, propylene, and butenes components of this material will readily vaporize and may contribute to generation of atmospheric smog.
Environmental Fate	<p>The atmospheric half-lives of ethane, ethylene, propane, propylene, and butenes under photochemical smog conditions are estimated to be between 5 to 8 hours. Experimental data shows that significant photooxidation of ethylene, propylene and butenes occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the butanes under photochemical smog conditions are estimated to be between 5 and 7 days. The pentanes have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of propane, isobutane, and n-butane in air (LT 8%) are not considered to be environmentally significant.</p> <p>Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%); and therefore, this material will not cause harm to aquatic life.</p> <p>For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)</p>

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Compressed gases, flammable, n.o.s. (Hydrogen, Methane)		
Hazard Class	CLASS 2.1 Flammable gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1954
Reportable Quantity	There are no Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display.		
Placards		Emergency Response Guide No.	115
		HAZMAT STCC No.	49 057 29
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	These streams and/or their components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. There are no chemical substances present in this material subject to this statute.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which are at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Ethylene or Ethene [CAS No. 74-85-1] concentration: 1 to 5% Propylene or Propene [CAS No. 115-07-1] concentration: 1 to 5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This material does not contain any chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
CWA	This material might be classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare" Ethylene (Ethene), Propylene (Propene), 1-Butene, Isobutylene, and n-Pentane. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this product which are subject to this statute are: Hydrogen, Methane, Ethane, Ethylene (Ethene), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), Butane, various Butenes, Isopentane (Butane, 2-methyl), n-Pentane, and 2,2-Dimethylpropane (Neopentane).

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	4.0
Revision Date	06/12/2000
Print Date	Printed on 06/14/2000

**Methane/Hydrogen-rich,
Sweet Refinery Gases
(C1-C5 Hydrocarbons)**

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Sulfur Plant Feed from the Sour Water Stripper

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0011
Revision Date 11/28/2001

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Compressed Gas.		
Color	Colorless to water white.	Odor	Faint to a strong, foul smelling, rotten egg or ammoniacal odor which is unreliable as a warning of possible exposure.

DANGER! Vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
Contains toxic Hydrogen Sulfide and Ammonia!
Extremely flammable and toxic compressed gas!
May be harmful or fatal if inhaled or absorbed!
High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation!
Compressed gas vapor, mist, or liquid contact may cause thermal burns and/or frostbite or freeze burns!
May react violently with acids, acidic solutions, or halogenated materials!
Reactions may generate extremely flammable Hydrogen!
May be corrosive to some metals!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

COR

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Sulfur Plant Feed from the Sour Water Stripper	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068783051*	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	68783-05-1	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Hydrogen Sulfide, Ammonia, Carbon Dioxide, and Water.		
Synonyms	Acid Gas; Sour Gas; Ammonia-Hydrogen Sulfide Gas; Sulfur Plant Feed from the Sour Water Stripper Overhead; Claus Unit Feed.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Ammonia-Hydrogen Sulfide Gases	68783-05-1	100
2) Hydrogen sulfide	7783-06-4	35-84
3) Ammonia	7664-41-7	10-40
4) Water (Steam)	7732-18-5	5-20
5) Carbon dioxide	124-38-9	1-5

Sulfur Plant Feed from the Sour Water Stripper

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye contact. Inhalation. Skin Absorption. Ingestion.

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health (NIOSH) has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are "immediately dangerous to life and health". At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death.</p> <p>Ammonia (NH₃) vapors may cause severe lung effects which might be delayed in onset. Symptoms are characterized by coughing, choking, or shortness of breath. Also, NIOSH has determined that atmospheres containing 300 ppm or more of NH₃ are "immediately dangerous to life and health". (See Section 11.)</p>
Eye Contact	<p>Hot vapor contact will cause severe thermal burns. Direct contact with cooled vapor may cause moderate irritation and photophobia (light sensitivity) upon short-term exposure; and, if not promptly removed, it can produce severe, and possibly permanent, tissue damage commonly referred to as a "freeze burn". The severity of the effects depend on the concentrations of hydrogen sulfide and ammonia, the duration of exposure, and how soon after exposure the eyes are washed.</p>
Skin Contact	<p>Hot vapor contact will cause severe thermal burns. Direct contact with an expanding gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Ammonia may be moderately irritating or corrosive to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solution (0.04 wt.% ammonia) to minutes with more concentrated solutions. Prolonged or repeated contact, even to dilute concentrations of ammonia solutions, may cause some degree of permanent tissue destruction. Hydrogen sulfide can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.</p>
Ingestion	<p>Ingestion is not an applicable route of exposure for gases. However, if the condensate portion of this mixture is swallowed, this material may cause gastrointestinal tract irritation, nausea, and vomiting, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon the ammonia concentration, ulceration of the gastrointestinal tract may also occur.</p>
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.</p> <p>Chronic dyspnea, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several workers two years after their occupational overexposures to mists or aerosols of ammonia. Also, when ingested by rats, aqueous ammonia solutions have been shown to cause gastrointestinal tract tumors.</p> <p>Long-term exposure to airborne carbon dioxide concentrations as low as 0.5 to 1% can alter the body's acid-base and calcium-phosphorus balance, resulting in metabolic acidosis and increased calcium deposits in soft tissues. Chronic exposure to levels of 1 to 2% CO₂ in air can stress the adrenal cortex because of constant respiratory stimulation; this level of exposure may be considered dangerous after several hours. CO₂ might also be a threat to the well-being of the unborn if a pregnant woman is exposed enough to cause metabolic acidosis. (See Section 11.)</p>
Conditions Aggravated by Exposure	<p>Personnel with pre-existing eye, skin, or gastrointestinal disorders, nervous system diseases, impaired kidney function, or chronic respiratory diseases neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material's components. They should take additional precautions to minimize or avoid exposure.</p>
Target Organs	<p>The material is potentially toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, and possibly the blood, heart, and/or the endocrine and reproductive systems.</p>
Carcinogenic Potential	<p>This material does not contain any components at concentrations above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP.</p>

Sulfur Plant Feed from the Sour Water Stripper

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	Flush thoroughly with water under a cool or cold shower for at least 15 minutes while removing contaminated shoes and clothing. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases, and groin area. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Thoroughly clean contaminated clothing before reuse.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a dilute solution of boric acid or acetic acid.</p> <p>Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Water (steam)-saturated compressed gas is non-flammable under normal conditions of use; however, if improperly handled, released H ₂ S or H ₂ vapors are Extremely Flammable!		
Flash Point Method	Not applicable or AP -76°C (-100°F) for H ₂ S. [ASTM D-56]		
Lower Flammable Limit	Not applicable or 4.0% for H ₂ S.	Upper Flammable Limit	Not applicable or 45% for H ₂ S.
Autoignition Temperature	Not applicable or AP 260°C (500°F) for H ₂ S.		

Sulfur Plant Feed from the Sour Water Stripper

Hazardous Combustion Products

Contact with some metals can generate extremely flammable **hydrogen (H₂)** gas. This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!

Special Properties

A volatile component of this gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. High heat, hot surface contact, or mixing with acids may spring steam, extremely flammable H₂S, and/or toxic NH₃ vapors out of an aqueous solution. H₂S is heavier than air and may travel long distances along the ground to an ignition source and flash back. It may also create a vapor/air explosion hazard in confined spaces such as in sewers. Adding this mixture directly to unbuffered water may cause a slightly exothermic reaction.

Extinguishing Media

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.

Protection of Fire Fighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

Sulfur Plant Feed from the Sour Water Stripper

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it contains **hydrogen sulfide (H₂S) and ammonia**. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, fixed or personal monitors can be used for detection and as an exposure monitoring system.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Sulfur Plant Feed from the Sour Water Stripper

Eye Protection	Thermal protection should be provided if the solution has a temperature above 120 degrees F. Suitable eye wash water should be readily available. Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
Hand Protection	Avoid skin contact. Use of chemical-resistant gloves (e.g., PVC, neoprene, rubber, or vinyl) is required. Thermal protection should be used whenever the solution has a temperature above 120 degrees F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.
Body Protection	Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (e.g., vinyl, Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. Thermal protection should be provided when the solution has a temperature above 120 degrees F. If general contact occurs, IMMEDIATELY remove soaked clothing and shower thoroughly. Contaminated leather goods should be removed immediately and discarded.
Respiratory Protection	Misting or vapor generation is not expected under normal conditions of use; so respiratory protection is not anticipated under normal use conditions and with adequate ventilation. However, when anticipated or if generated hydrogen sulfide or ammonia are present at concentrations above applicable workplace exposure levels, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases may create flammable, explosive, toxic, and/or oxygen-deficient atmospheres (< 19.5 Vol.% in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency and hydrogen sulfide. Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners. Exposure standards/control limits for some of the components apply to airborne concentrations of dust, and are not truly applicable to liquid solutions. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 5 (ppm) from ACGIH (TLV) [Proposed]
2) Ammonia	TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) TWA: 25 STEL: 35 (ppm) from ACGIH (TLV) TWA: 50 STEL: 35 (ppm) from OSHA (PEL) STEL: 35 (ppm) from OSHA (PEL) [Proposed]
3) Carbon dioxide	TWA: 5000 STEL: 30000 (ppm) from ACGIH (TLV) TWA: 5000 STEL: 30000 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Compressed Gas.	Color	Colorless to water white.	Odor	Faint to a strong, foul smelling, rotten egg or ammoniacal odor which is unreliable as a warning of possible exposure.
Specific Gravity	0.62 to 0.82 (Water = 1)	pH	6.0 to 12.0 In the presence of moisture, H ₂ S can convert to acid H ₂ SO ₄ .	Vapor Density	1.00 to 1.50 (Air = 1)
Boiling Point/Range	-79° to 100°C (-110° to 212°F) at 14.7 psia.	Melting/Freezing Point		Viscosity (cSt @ 40°C)	-129° to 0°C (-200° to 32°F) at 14.7 psia. Not applicable.
Vapor Pressure	212 to 394 psia at 100°F (based upon H ₂ S and NH ₃)	Volatile Characteristics		Characteristics	Negligible volatility in proper storage. 100% upon release.
Solubility in Water	Completely soluble in cold water; but may cause an exothermic reaction.				

Sulfur Plant Feed from the Sour Water Stripper

Additional Properties A 1% solution of ammonia has a greater than 9.0 pH. Ammonia has a vapor density lighter than air and will disperse rapidly; however, hydrogen sulfide has a vapor density heavier than air and will tend to accumulate in low places or travel along the ground creating a flashback fire hazard.

This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard.
Average Density at 60°F = 3.0 to 4.50 lbs./gal. (ASTM D-2161);
Gross Heat of Combustion at 60°F = 350 to 550 Btu/cu.ft.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from strong acids, heat and hot surfaces, strong oxidizing conditions, and severe agitation. Contact with some metals can generate extremely flammable hydrogen (H ₂) gas.		
Materials Incompatibility	Strong acids, halogenated compounds, and some heavy metals. Ammonia solutions are corrosive to chromium and silver and alloys containing these metals and will react violently with their powdered forms.		
Hazardous Decomposition Products	Sulfur dioxide. Free aromatic amines may be released in a reducing environment.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen sulfide:

- GAS (TC_{Lo}): Acute: 10 ppm for 15 minutes [Human] - Eye irritation.
- GAS (TC_{Lo}): Acute: 50 to 100 ppm for 15 minutes [Human] - Respiratory irritation.
- GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death.
- GAS (LC_{Lo}): Acute: 5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death.

Ammonia:

- ORAL (LD_{Lo}): Acute: 132 mg/kg [Human].
- ORAL (TD_{Lo}): Acute: 15 uL/kg [Human] - Structural changes in the esophagus.
- GAS (TC_{Lo}): Acute: 20 ppm for 1hour [Human] - Eye irritation, ulcerated nasal septum, and structural changes in the trachea or bronchi.
- GAS (LC_{Lo}): Acute: 5,000 ppm for 5 minutes [Human].
- GAS (LC_{Lo}): Acute: 5,000 ppm for 5 minutes [Guinea Pig].
- GAS (LC₅₀): Acute: 2,000 ppm for 4 hours [Rat].
- GAS (LC₅₀): Acute: 7,000 mg/m³ for 1 hour [Cat and Rabbit] - Excitement and flaccid paralysis without anesthesia.
- GAS (LC₅₀): Acute: 4,230 ppm for 1 hour [Mouse] - Ataxia, tremors, and convulsions.

Carbon dioxide:

- GAS (LC_{Lo}): Acute: 90,000 ppm for 5 minutes [Human and Dog].
- GAS (TC_{Lo}): Chronic: 10,000 ppm for 24 hours for 30 days [Rat] - Blood compositional changes.
- GAS (TC_{Lo}): Chronic: 27,000 ppm for 24 hours for 30 days [Rabbit] - Somnolence.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (> 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Sulfur Plant Feed from the Sour Water Stripper

Ammonia is a strong base and forms **ammonium hydroxide** upon contact with water. This material is corrosive to many organic compounds. If ingested, ammonia can cause severe pain, bloody diarrhea, cardiovascular collapse, and death. Concentrated ammonia is a strong corrosive which can cause burns of the following types: cryogenic from contact with refrigerated liquid, thermal from exothermic reaction with water, and chemical from its alkalinity. It gelatinizes the tissue, forming deep and painful lesions. At low concentrations, aqueous ammonia is a moderate to strong irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. Its effects on the lungs can be severe and delayed in onset; respiratory support may be required following acute inhalation. However, there seems to be a wide variability in the human sensitivity to ammonia.

Chronic dyspnea, restrictive lung dysfunction, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several employees two years after their occupational overexposures to mists and aerosols of **ammonia**. An **aqueous ammonia solution** caused gastrointestinal cicatricial tumors in rats following a 24-week feeding assay. NH_3 produced a positive mutagenic response in the Ames Assay and caused chromosomal aberrations during a 16-week cytogenic study using rats. However, in general, pH alterations produce false positive results in short-term genetic assays.

Many people have died from overexposure to **carbon dioxide (CO_2) gas**. CO_2 exerts direct toxicity on the heart, resulting in diminished contractile force. It is also a vasodilator, and is the most potent cerebrovascular dilator known. At an airborne concentration of 5,500 ppm for 6 hours, CO_2 has no ill effects, while at 3% (30,000 ppm) it is mildly narcotic and causes reduced hearing, increased blood pressure, and rapid pulse. Its IDLH has been determined to be 40,000 ppm (4%) in air. Concentrations of 50,000 to 80,000 ppm (5 to 8%) produce normal symptoms of hypoxia (see Section 3) within 10 minutes. And, at 8 to 10% in air, CO_2 causes tremors, hypertension, difficulty in breathing, and loss of consciousness within 5 to 10 minutes. Extended exposure to concentrations between 10 and 15% can be lethal. Breathing 20% CO_2 in air for 1 minute causes convulsions, unconsciousness, and usually death.

Long-term exposure to airborne **carbon dioxide** concentrations as low as 0.5 to 1%, while being generally well tolerated, can alter the body's acid-base and calcium-phosphorus balance, resulting in metabolic acidosis and increased calcium deposits in soft tissues. Chronic exposure to levels of 1 to 2% CO_2 in air can stress the adrenal cortex because of constant respiratory stimulation; if not given a period of gradual adaption, this level of exposure is considered dangerous after several hours. CO_2 might also be a threat to the well-being of the unborn if a pregnant woman is exposed enough to cause metabolic acidosis. This decreases the blood supply to the uterus which increases fetal breathing movements and reduces fetal development. Also, laboratory rat studies suggest that CO_2 exposures may adversely affect male reproduction by altering the testes causing premature release of sperm and reduced fertility.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Vapor releases from this material are expected to cause significant immediate impact but only localized non-persistent environmental damage. Due caution should be exercised to prevent an accidental release into the environment. This material and any contaminated soil or other water may be hazardous to human, animal, and aquatic life. Volatile components may contribute to smog formation.

Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.

Environmental Fate

This material is soluble in water and is expected to readily disperse in marine environments. Caustic solutions have produced slight to moderate toxicity in laboratory tests with aquatic organisms. It is expected to be moderately alkaline. If released to surface water, it may cause a pH rise depending upon the buffering capacity of the waterbody. Aquatic organisms become increasingly stressed as pH concentration exceeds 9.0, with many species being intolerant of pH of 10.0 or higher. Substances in this mixture do not bioaccumulate.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

Sulfur Plant Feed from the Sour Water Stripper

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. Maximize component recovery prior for reuse or recycling. This material may disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Compressed gas, toxic, flammable, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide and Ammonia)		
Hazard Class	2.3 (Poisonous gas)	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953

Reportable Quantity Reportable Quantity (RQ) substance components present in this material which require DOT HAZMAT bill-of-lading display is **Hydrogen sulfide and Ammonia**. (See Section 15.)

Placards



Emergency Response Guide No. 119

HAZMAT STCC No. 49 203 78

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.

SARA 302/304 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material contains the following chemical substances which are subject to this statute:

Hydroxide sulfide [CAS No. 7783-06-4] concentration: 35 to 84%

Ammonia [CAS No. 7664-41-7] concentration: 10 to 40%.

SARA 311/312 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

Acute (Immediate) & Chronic (Delayed) Health, Sudden Release of Pressure, Fire, and Reactivity Hazards

SARA 313 This material contains the following components in concentrations which are at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313:

Hydroxide sulfide [CAS No. 7783-06-4] concentration: 35 to 84%

Ammonia [CAS No. 7664-41-7] concentration: 10 to 40%.

Sulfur Plant Feed from the Sour Water Stripper

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are:

Hydroxide sulfide [CAS No. 7783-06-4] concentration: 35 to 84%
Ammonia [CAS No. 7664-41-7] concentration: 10 to 40%.

CWA

This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).

**California
Proposition 65**

This material does not contain any ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.

**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2.

**Additional Regulatory
Remarks**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Chemical substances present in this material subject to this statute are:

Hydroxide sulfide [CAS No. 7783-06-4] concentration: 35 to 84%
Ammonia [CAS No. 7664-41-7] concentration: 10 to 40%.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 11/28/2001
Print Date Printed on 11/28/2001.

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists				AIHA = American Industrial Hygiene Association		
IARC = International Agency for Research on Cancer				NTP = National Toxicology Program		
NIOSH = National Institute of Occupational Safety and Health				OSHA = Occupational Safety and Health Administration		
NPCA = National Paint and Coating Manufacturers Association				HMIS = Hazardous Materials Information System		
NFPA = National Fire Protection Association				EPA = Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

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***** END OF MSDS *****

Material Safety Data Sheet

MSDS No.
RS0015

Acid Scrubber Off Gas

HMIS	IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product. This product is covered by the OSHA Hazard Communication Standard and this document has been prepared in accord with the MSDS requirements of the rule.	Protective Equipment
Health Hazard *4		
Fire Hazard 4		
Reactivity 0		
* = Chronic Health Hazard		

SECTION 1: IDENTIFICATION

Trade Name	Acid Scrubber Off Gas	MSDS No.	RS0015
Product Number	068527139*	Revision Date	6/24/97
CAS Number	68527-13-9		
Synonyms	Recycled hydrogen sulfide, Sour off gas		
Generic Name	Gases, petroleum, acid, ethanolamine scrubber		
Chemical Family	Hydrogen sulfide and carbon dioxide		
Manufacturer	LYONDELL-CITGO Refining Company Ltd. 12000 Lawndale Avenue P O Box 2451 Houston, Texas 77252-2451	Telephone Numbers	800/424-9300 CHEMTREC 800/313-7645 Company Hot Line 713/321-4215 MSDS Requests

SECTION 2: COMPOSITION

Component Name	CAS Number	Carcinogenic Listings	Concentration Wt%
HYDROGEN SULFIDE (H ₂ S)	7783-06-4	Not applicable	AP 47 to 54
CARBON DIOXIDE (CO ₂)	124-38-9	Not applicable	AP 46 to 53

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Signal Word	DANGER!	Color	Colorless.
Physical State	Gas	Odor	Strong, rotten egg-like odor from 0.1 ppm to 100 ppm Sense of smell may be deadened above 100 ppm.
Physical and Health Hazards	Extremely flammable, poisonous gas; may be harmful or fatal if inhaled! Eye and respiratory system irritant. Compressed gases have a potential hazard of sudden release of pressure. Contact with liquefied or compressed gas may cause frostbite or freeze burns. Corrosive to some metals.		
Environmental Hazards	Ecological effects testing has not been conducted on this product. If released, it could have detrimental effects until dissipated.		

POTENTIAL HEALTH EFFECTS

Routes of Exposure Inhalation, skin and eye contact, and skin absorption.

Signs and Symptoms of Acute Exposure

• <i>Inhalation</i>	Poison; may be fatal if inhaled! Concentrations of hydrogen sulfide at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. H ₂ S concentrations between 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, low blood pressure, and/or coma. Greater than 500 ppm H ₂ S may cause sudden collapse, respiratory paralysis, convulsions, and death. Inhalation of high concentrations of CO ₂ may adversely affect vision.
• <i>Eye Contact</i>	Vapors may cause moderate to severe eye irritation and sensitivity to light. Direct contact with liquefied/pressurized gas may produce severe and possibly permanent damage from freeze burns.
• <i>Skin Contact</i>	Hydrogen sulfide is non-irritating to the skin, but can be absorbed to produce toxic effects (see <i>Inhalation</i> above). Direct contact with liquefied/pressurized gas may produce severe and possibly permanent damage from freeze burns.
• <i>Ingestion</i>	Ingestion is not an applicable route of exposure for gases.
Chronic Health Effects Summary	Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.
Conditions Aggravated by Exposure	Personnel with pre-existing eye, respiratory, cardiac, or neurological conditions should take additional precautions to minimize or avoid exposure.
Target Organs	This substance may be toxic to the eyes, central nervous system, upper respiratory system, lungs, heart, and possibly the reproductive systems.
Carcinogenic Potential	Please refer to Sections 2 and/or 11 for the identification of components, if any, which have been identified as having carcinogenic potential in animals and/or humans.

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS.

Inhalation	Move the exposed person to fresh air at once. If breathing has stopped, initiate artificial respiration; if the heart has stopped, initiate CPR. When breathing is difficult, properly trained personnel may administer 100% oxygen. Keep the affected person warm and at rest. Get medical attention as soon as possible.
Eye Contact	If eye tissue is frozen, seek medical attention immediately. If tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation, pain, swelling, tearing or light sensitivity persists, obtain medical attention as soon as possible.
Skin Contact	If frostbite has occurred, seek medical attention immediately. Do not rub the affected areas or flush them with water. In order to prevent further damage, do not attempt to remove frozen clothing from frostbitten areas. If frostbite has not occurred, immediately and thoroughly wash contaminated skin with mild soap and water.
Ingestion	Ingestion is not a route of exposure.
Notes to Physician	Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal.

SECTION 5: FIRE FIGHTING MEASURES**FLAMMABLE PROPERTIES**

Flammability	Extremely flammable gas!
Classification	
Flash Point/Method	LT -105°F (-77°C)/ ASTM D-56
Flammable Limits %	LEL: AP 4.0 UEL: AP 44 (based on NFPA hydrogen sulfide)
Auto-Ignition Temperature	AP 500°F (260°C, based on NFPA hydrogen sulfide).
Hazardous Combustion Products	Burning or excessive heating may produce oxides of carbon and/or sulfur.
Special Properties	Extremely flammable gas; exposed to an ignition source it will burn in the open or explode in a confined space. Being heavier than air, its flammable vapors may travel long distances along the ground before reaching a source of ignition and flashing back. Vapors may collect in low or confined areas. Containers may explode when heated.

EXTINGUISHING MEDIA

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED!
Cool tanks and containers with water fog or spray in order to prevent pressure build-up, autoignition or explosion. Use water, dry chemical, carbon dioxide, or inert gas to extinguish adjacent burning materials.

FIRE FIGHTING

Protective Equipment/Clothing: Wear a NIOSH-approved positive pressure self-contained breathing apparatus and firefighter's turnout gear.

Instructions: STOP GAS FLOW! Evacuate area and fight from a maximum distance or use unmanned hose holders or monitor nozzles. Use water spray to reduce vapors or divert vapor cloud drift. Containers can build up pressure if exposed to heat; cool with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or pressure relief devices, icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel. ALWAYS stay away from the ends of "bullet" tanks.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS.

Eliminate all ignition sources. Wear vapor protective, fully encapsulating clothing for spills and leaks with no fire. Keep upwind; do not enter release. Stop leak if you can do so without risk; use non-sparking tools.

Use water spray to disperse vapors or divert vapor cloud drift. Do not direct water at source of leak. Prevent vapors from entering sewers, ventilation systems and confined areas. Isolate area until gas has dispersed.

SECTION 7: HANDLING and STORAGE**Handling**

Do not breathe this gas. Hydrogen sulfide's rotten egg-like odor is not reliable as a warning of possible exposure! Do not enter storage areas unless adequately ventilated. Keep containers tightly closed. Use only in a closed system constructed from resistant materials. Emergency self-contained breathing apparatus should be readily available. A continuous monitoring system with alarms is recommended for work areas where H₂S is routinely present.

Keep away from heat, sparks, flame and other sources of ignition. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Emergency eye wash stations should be nearby. Train workers about this material's hazards and how to handle accidental release situations.

Hydrogen sulfide is very corrosive to all electro-chemical series metals. It can cause pipes and valves to corrode and become blistered, pitted and brittle. Lines and fittings likely to contain H₂S should be inspected frequently and receive special attention, monitoring and maintenance to prevent leaks. Metal components used in H₂S service should be resistant to sulfide stress cracking.

Storage

Keep away from heat, sparks and other sources of ignition; segregate from incompatible materials. Store original container tightly closed in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Ground all containers and transfer vessels.

Cylinders must be stored upright and firmly secured; avoid placing them in high-traffic areas. Valve caps should remain on all cylinders not in use. Storage and handling facilities should meet the applicable requirements of the National Electrical Code and National Fire Protection Association standards.

SECTION 8: EXPOSURE CONTROLS and PERSONAL PROTECTION**ENGINEERING CONTROLS**

Engineering controls are normally required when handling this material. Use closed system or other controls to maintain airborne levels below recommended exposure limits. Engineering controls should meet applicable requirements of the National Electrical Code. Storage or handling facilities should be equipped with an emergency eyewash station and safety shower.

PERSONAL PROTECTIVE EQUIPMENT• *Protective Equipment*• *Eye Protection*

A full-face supplied air respirator with escape bottle or a positive-pressure pressure-demand self-contained breathing apparatus (SCBA) is required.

• *Skin Protection*- *Hands*

Use Neoprene or PVC/Nitrile gloves. When handling hot materials or those that can produce frostbite or cold burns, use leather gloves over chemically resistant gloves.

- *Body*

Avoid skin contact; wear chemical resistant protective clothing. This might include apron, slicker suit, boots, and additional facial protection.

• *Respiratory Protection*

A full-face supplied air respirator with escape bottle or a positive-pressure pressure-demand self-contained breathing apparatus (SCBA) is required.

• *General Comments*

A cartridge respirator offers NO PROTECTION against hydrogen sulfide (H₂S).

EXPOSURE GUIDELINES

Substance	Source	Date	Type	Value	Time
HYDROGEN SULFIDE	OSHA	1989	PEL	10 ppm	8 hours
HYDROGEN SULFIDE	OSHA	1989	STEL	15 ppm	15 minutes
HYDROGEN SULFIDE	OSHA	1989	CEILING	20 ppm	NA
HYDROGEN SULFIDE	ACGIH	1996	TLV	10 ppm	8 hours
HYDROGEN SULFIDE	ACGIH	1996	STEL	15 ppm	15 minutes
CARBON DIOXIDE	OSHA	1989	PEL	10,000 ppm	8 hours
CARBON DIOXIDE	OSHA	1989	STEL	30,000 ppm	15 minutes
CARBON DIOXIDE	ACGIH	1996	TLV	5,000 ppm	8 hours
CARBON DIOXIDE	ACGIH	1996	STEL	30,000 ppm	15 minutes

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas		
Color	Colorless.		
Odor	Strong, rotten egg-like odor from 0.1 ppm to 100 ppm. Sense of smell may be deadened above 100 ppm.		
pH	Not applicable.		
Vapor Pressure	AP 19 psia at 68 °F	Viscosity	Not applicable.
Vapor Specific Gravity	AP 1.2 to 1.5 (air = 1.0 at 60°F)	Melting/Freezing Pt.	AP -117°F (-83°C)
Volatile Characteristics	Complete (100 %)	Solubility in Water	Appreciable (> 10%)
Boiling Point/Range	AP -109° to -76°F (-78° to -60°C)	Specific Gravity	Less than 1.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard.		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.
Conditions to Avoid	Heat, flame, or strong oxidizing materials.
Incompatibility with Other Materials	Dangerously reactive with strong oxidizing materials (nitric acid, chlorine, fluorine, etc.), some metals, metal oxides, and metal powders. Corrosive to some metals and alloys, especially those containing copper and/or tungsten
Hazardous Decomposition Products	No degradation data available.
Hazardous Polymerization	Not expected to occur.

SECTION 11: TOXICOLOGICAL INFORMATION**HYDROGEN SULFIDE (H₂S)**Acute

TE _{Lo} Human:	AP 1 ppm - Odor response threshold
TC _{Lo} Human:	AP 10 ppm for 15 minutes - Eye irritation
TC _{Lo} Human:	50 to 100 ppm for 15 minutes - Respiratory irritation
IDLH Value:	100 ppm
LC _{Lo} Human:	600 ppm for 30 minutes
LC ₅₀ Mouse:	673 ppm for 1 hour
LC ₅₀ Rat:	444 ppm for 4 hours

Subchronic

5 weeks Rats: 100 ppm for 8 hours/day - pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase.

Reproductive Effects

One unconfirmed study mentions H₂S as causing damage to the testes and/or male reproduction. Recent studies do not confirm this association.

CARBON DIOXIDE (CO₂):Acute

LC_{Lo} Human: 90,000 ppm for 5 minutes

LC_{Lo} Guinea Pig: 90,000 ppm for 5 minutes

Subchronic

30-Day Rat. 10,000 ppm for 24 hours/day - Blood changes.

30-Day Rabbit: 27,000 ppm for 24 hours/day - Somnolence.

42-Day Human males: 15,000 ppm for 24 hours/day - Headaches, deepened respiration, breathing difficulty upon exertion, metabolic acidosis, and increased calcium deposits in soft tissues.

Reproductive Effects

No human reproductive data concerning CO₂ is available, however, carbon dioxide has been reported to have a variety of reproductive effects in experimental animals including changes in sperm production and reduced fertility. The well-being of the unborn may be at risk if the mother is exposed to a concentration sufficient to render her unconscious.

SECTION 12: ECOLOGICAL INFORMATION

Hydrogen sulfide is toxic to both plants and animals and is harmful to aquatic life in very low concentrations. If it is spilled onto the soil, it will be rapidly released to the atmosphere.

However, it is soluble in water and the presence of precipitation or ground water at the time of the spill will influence its environmental fate. Residence times in the atmosphere range from one day to more than 40 days, depending upon season, and atmospheric conditions.

SECTION 13: DISPOSAL CONSIDERATIONS

Dispose of by burning in a properly designed and permitted flare or incinerator. Venting of this gas to the atmosphere should be avoided.

SECTION 14: TRANSPORT INFORMATION

DOT Status A U.S. Department of Transportation regulated material.
Proper Shipping Name Compressed gases, toxic, flammable, n.o.s. (hydrogen sulfide)
Inhalation Hazard Zone B
Hazard Class 2.3
UN/NA ID UN1953
Reportable Quantity RQ (HYDROGEN SULFIDE)

Packing Group(s) NA

Placards



Emergency Response Guide Number 119

HAZMAT STCC Number 49 203 78

MARPOL III Status Not a "Marine Pollutant".

SECTION 15: REGULATORY INFORMATION

TSCA	All components of this product are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning and notification based on Threshold Planning Quantities (TPQ's) and Reportable Quantities (RQ's) listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances present in this product subject to this statute are: HYDROGEN SULFIDE
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Immediate Health Hazard, Delayed Health Hazard, Fire Hazard, and Sudden Release of Pressure
SARA 313	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of an annual Toxic Chemical Release Inventory Report (Form R) by facilities which receive, import, make, process, or otherwise use "Toxic Chemicals" above specified threshold quantities. These facilities must also notify their customers if a product contains "Toxic Chemicals" regulated under 40 CFR 372.65. This information must also be included in all MSDS's that are copied and distributed for the product. Chemical substances present in this product subject to this statute are: HYDROGEN SULFIDE
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of hazardous substances equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. Chemical substances present in this product subject to this statute are: HYDROGEN SULFIDE RQ: 100 Pound(s) (45.4 Kg)
California Proposition 65	The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) requires warning be given for ingredients known to the State of California to cause cancer, birth defects, or other reproductive toxicity. This product contains no known chemical substances subject to this statute.
Additional Regulatory Remarks	The Clean Air Act Section 112(r) of 1993 requires development, implementation, and submission of risk management plans for facilities that manufacture, process, use, store or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this stream which are subject to this statute are: CARBON DIOXIDE and HYDROGEN SULFIDE.

SECTION 16: OTHER INFORMATION**HMIS (U.S.A.)**

Health Hazard	*4
Fire Hazard	4
Reactivity	0

* = Chronic Health Hazard

National Fire Protection Association (U.S.A.)

REVISION INFORMATION

Version Number 03
Revision Date 6/24/97
Latest Revision MSDS updated and converted to ANSI 16-section format on 6/09/97.
Print Date Printed on 3/15/100.

ABBREVIATIONS

AP = Approximately EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data
ACGIH = American Conference of Governmental Industrial Hygienists
IARC = International Agency for Research on Cancer NTP = National Toxicology Program
NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration

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***** END OF MSDS *****



Sour Refinery Gases (C1-C4 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0018
Revision Date 10/15/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquefied Gas.		
Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure.

DANGER! Extremely flammable and poisonous gas/liquid;
vapor may cause flash fire or explosion.
High pressure and rapid diffusion hazard.
High vapor concentrations reduce oxygen available for breathing.
Contains Hydrogen Sulfide (H₂S).
May be harmful or fatal if inhaled or absorbed through the skin.
May cause central nervous system (CNS) depression
or suffocation.
Compressed gas/liquid contact may cause frostbite/freeze burns.
Mist or vapor may cause mild to severe eye, skin, mucous
membrane, and respiratory tract irritation and inflammation.
Aspiration into the lungs will cause pulmonary edema and
chemical pneumonia.
Overexposures may cause central nervous system (CNS)
depression and other target organ effects.
Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats).
Corrosive to some metals.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Sour Refinery Gases (C1-C4 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068477929*	Medical Emergency	(918) 495-4700
CAS Number	68477-92-9	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Sour Hydrocarbon Gas Mixture		
Synonyms	Sour Light Refinery Gas; Sour Light Gases; Sour C1-C4 Mix with Hydrogen; Gas Blend containing Hydrogen and Hydrogen Sulfide; C1-C4 Hydrocarbons, H ₂ , and H ₂ S.		

Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Sour C1-C4 Hydrocarbons	68477-92-9	100
2) Hydrogen sulfide	7783-06-4	0.05-5
3) Ammonia	7664-41-7	0-0.9
4) Hydrogen	1333-74-0	1-10
5) Methane	74-82-8	1-15
6) Ethane	74-84-0	5-15
7) Ethylene	74-85-1	1-5
8) Propane	74-98-6	15-30
9) Propylene	115-07-1	1-10
10) Isobutane	75-28-5	15-25
11) Butenes or Butylenes	25167-67-3	1-10
12) n-Butane	106-97-8	10-20

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact. Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. **Ammonia** vapors may cause severe lung effects which might be delayed in onset. Symptoms are characterized by coughing, choking, or shortness of breath. NIOSH has determined that atmospheres containing 100 ppm or more of **hydrogen sulfide (H₂S)** are immediately dangerous to life and health. At concentrations above 500 ppm, **H₂S** cause unconsciousness and respiratory paralysis leading to coma and/or death. Also, NIOSH has determined that atmospheres containing 300 ppm or more of **ammonia (NH₃)** are immediately dangerous to life and health. (See Section 11.)

Additionally, at least one component of this gas/liquid mixture is a "simple asphyxiant". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.

Breathing high concentrations of the liquid-phase vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes.

Eye Contact

Vapors may cause mild to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentration of **hydrogen sulfide and ammonia** and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Direct liquid contact can cause clouding of the cornea with small areas of superficial corneal necrosis.

Direct liquid contact may cause eye irritation and clouding of the cornea with small areas of superficial corneal necrosis upon short-term exposure and can produce severe, and possibly permanent, tissue damage if not promptly removed. The severity of the effects depend on the concentration of the **ammonia** component and how soon after exposure the eyes are washed.

Sour Refinery Gases (C1-C4 Hydrocarbons)

Skin Contact	<p>May be moderately irritating or corrosive to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solution (0.04 wt.% ammonia) to minutes with more concentrated solutions. Prolonged or repeated contact, even to dilute concentrations of ammonia solutions, may cause some degree of permanent tissue destruction.</p> <p>Direct contact with a liquefied/pressurized gas portion of this material may produce severe and possibly permanent skin damage from frostbite or freeze burns. Tests on this material's components suggest that moderate to severe skin irritation, inflammation, and blistering is expected to occur upon short-term liquid contact. Hydrogen sulfide may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases.</p>
Ingestion	<p>Ingestion of this material is highly unlikely due to its volatile nature. However, if swallowed, this material may cause gastrointestinal tract irritation, nausea, and vomiting, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon the ammonia concentration, ulceration of the gastrointestinal tract may also occur. Additional central nervous system (CNS) effects may occur prior to the onset of convulsions, coma, and death.</p> <p>Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.</p>
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.</p> <p>Chronic dyspnea, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several workers two years after their occupational overexposures to mists or aerosols of ammonia. Also, when ingested by rats, aqueous ammonia solutions have been shown to cause gastrointestinal tract tumors.</p> <p>Chronic inhalation to components of this material (propane, propylene, isobutane, and n-butane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs. (See Section 11.)</p>
Conditions Aggravated by Exposure	<p>Personnel with pre-existing eye, skin, cardiac, pulmonary, liver, kidney, or neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics, anemics, and those with reduced pulmonary function, may be more sensitive to excess concentrations of this material's components. They should take additional precautions to minimize or avoid exposure.</p>
Target Organs	<p>This material is toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, blood, and possibly, the endocrine and reproductive systems.</p>
Carcinogenic Potential	<p>This material does not contain any components at concentrations above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP.</p>

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Be particularly careful to clean folds, crevices, creases, and groin area. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Nitrite as an antidote for acute hydrogen sulfide intoxicification may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.</p> <p>Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a dilute solution of boric acid or acetic acid.</p> <p>This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas and Liquefied Gas.		
Flash Point Method	CLOSED CUP: AP -107° to -73°C (-160° to -100°F). (Estimated)		
Lower Flammable Limit	1.6 to 4.0%	Upper Flammable Limit	AP 45%
Autoignition Temperature	260° to 288°C (500° to 550°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans.		

Sour Refinery Gases (C1-C4 Hydrocarbons)

Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas/Liquid Mixture! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. Cover spill with a vapor-suppressing foam as soon as possible. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off.

SECTION 7: HANDLING AND STORAGE

Sour Refinery Gases (C1-C4 Hydrocarbons)

Handling

Danger! Corrosive or Irritating Liquid and/or Poisonous and Flammable Gas! Do NOT breathe mist or vapor; it may contain **hydrogen sulfide (H₂S)**, **ammonia (NH₃)**, and/or **simple asphyxiants**. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where **hydrogen sulfide and/or ammonia** are routinely stored or handled, install monitoring equipment or system with alarms and special ventilation will be required.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Sour Refinery Gases (C1-C4 Hydrocarbons)

Hand Protection	Avoid skin contact and use gloves (e.g. disposable neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this gas/liquid mixture may create flammable, explosive, corrosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Air purifying respirators offer no protection against hydrogen sulfide, ammonia, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 5 (ppm) from ACGIH (TLV) [Proposed]
2) Ammonia	TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) TWA: 25 STEL: 35 (ppm) from ACGIH (TLV) TWA: 50 STEL: 35 (ppm) from OSHA (PEL) STEL: 35 (ppm) from OSHA (PEL) [Proposed]
3) Hydrogen	Simple asphyxiant.
4) Methane	Simple asphyxiant.
5) Ethane	Simple asphyxiant.
6) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
7) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
8) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas.	Color Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure.
Specific Gravity	0.30 to 0.59 (Water = 1)	pH In the presence of moisture, H ₂ S can convert to H ₂ SO ₄ .	Vapor Density	0.55 to 2.0 (Air = 1)
Boiling Point/Range	-253°C to -1°C (-423° to 31°F) [ASTM D-2887]		Melting/Freezing Point	-259° to -139°C (-435° to -217°F) at 14.7 psia.
Vapor Pressure	200 to 400 psia at 100°F.		Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Moderately soluble in cold water.		Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Hydrogen Sulfide and Ammonia Content = 0.1 to 13 Wt.%; Alkane, Isoparaffin, Alkene, and Cycloalkane Hydrocarbons Content = 87 to 99.9 Wt.% [ASTM D-1319]; Average Density at 60°F = AP 4.50 lbs./gallon [ASTM D-2161].			

Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, calcium hypochlorite, chlorates, permanganates, nitrates, hydrogen peroxide, mercury oxide, and oxygen. Oxidizer mixtures and alkane hydrocarbons and chlorine gas mixtures have produced explosions. Under some conditions, mercaptans may react with water or steam to produce additional toxic and flammable vapors.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data

Hydrogen sulfide:

GAS (TC_{Lo}): Acute: 10 ppm for 15 minutes (Human) - Eye irritation.

GAS (TC_{Lo}): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation.

GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death.

GAS (LC_{Lo}): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.

Ammonia:

ORAL (LD_{Lo}): Acute: 132 mg/kg [Human].

ORAL (TD_{Lo}): Acute: 15 uL/kg [Human] - Structural changes in the esophagus.

GAS (TC_{Lo}): Acute: 20 ppm for 1hour [Human] - Eye irritation, ulcerated nasal septum, and structural changes in the trachea or bronchi.

GAS (LC_{Lo}): Acute: 5,000 ppm for 5 minutes [Human].

GAS (LC_{Lo}): Acute: 5,000 ppm for 5 minutes [Guinea Pig].

GAS (LC₅₀): Acute: 2,000 ppm for 4 hours [Rat].

GAS (LC₅₀): Acute: 7,000 mg/m³ for 1 hour [Cat and Rabbit] - Excitement and flaccid paralysis without anesthesia.

GAS (LC₅₀): Acute: 4,230 ppm for 1 hour [Mouse] - Ataxia, tremors, and convulsions.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (> 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Ammonia is a strong base and forms **ammonium hydroxide** upon contact with water. This material is corrosive to many organic compounds. If ingested, ammonia can cause severe pain, bloody diarrhea, cardiovascular collapse, and death. Concentrated ammonia is a strong corrosive which can cause burns of the following types: cryogenic from contact with refrigerated liquid, thermal from exothermic reaction with water, and chemical from its alkalinity. It gelatinizes the tissue, forming deep and painful lesions. At low concentrations, aqueous ammonia is a moderate to strong irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. Its effects on the lungs can be severe and delayed in onset; respiratory support may be required following acute inhalation. However, there seems to be a wide variability in the human sensitivity to ammonia.

Chronic dyspnea, restrictive lung dysfunction, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several employees two years after their occupational overexposures to mists and aerosols of ammonia.

Sour Refinery Gases (C1-C4 Hydrocarbons)

An **aqueous ammonia solution** caused gastrointestinal cicatrized tumors in rats following a 24-week feeding assay. NH_3 produced a positive mutagenic response in the Ames Assay and caused chromosomal aberrations during a 16-week cytogenic study using rats. However, in general, pH alterations produce false positive results in short-term genetic assays.

Propylene:

GAS (LC_{50}): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse].

GAS (TC_{Lo}): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.

Iso-Butane:

GAS (TC_{Lo}): Acute: 1,040,000 mg/m^3 for 2 hours [Mouse] - Excitement.

GAS (LC_{50}): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

Iso-Butene (Isobutylene or 2-Methylpropene):

GAS (LC_{50}): Acute: 415,000 mg/m^3 for 2 hours [Mouse].

GAS (LC_{50}): Acute: 620,000 mg/m^3 for 4 hours [Rat].

n-Butane:

GAS (LC_{50}): Acute: 660,000 mg/m^3 for 4 hours [Rat].

GAS (LC_{50}): Acute: 680,000 mg/m^3 for 2 hours [Mouse].

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to **propylene** may entail a possible hazard from the formation of a reactive metabolite, **propylene oxide**, which is a "suspect human carcinogen". However, propylene have not been shown to be carcinogenic in rat studies. For example, propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. **Propylene** is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane and n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylene** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	<p>Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the hydrogen sulfide and ammonia components of this material may contribute to generation of atmospheric smog. The atmospheric half-life of propane under photochemical smog conditions are estimated to be between 5 to 8 hours. The atmospheric half-lives of butanes under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of propane, isobutane, and n-butane in air (< 8%) are not considered environmentally significant.</p> <p>Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.</p>
Environmental Fate	<p>Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (< 0.1%); however, hydrogen sulfide is moderately soluble in water so this material and any contaminated soil or water may be hazardous to human, animal, and aquatic life.</p> <p>For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)</p>

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas/liquid to the atmosphere should be avoided. Maximize material recovery for reuse or recycling.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitability (D001) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation (DOT) regulated material.		
Proper Shipping Name	Compressed gases, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Hydrogen)		
Hazard Class	DOT Class: 2.3 (Poisonous gas) and 2.1 (Flammable gas).	Packing Group(s) UN/NA ID	Not applicable. UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Hydrogen sulfide and Ammonia .		

Sour Refinery Gases (C1-C4 Hydrocarbons)

Placards



Emergency Response Guide No. 119

HAZMAT STCC No. 49 057 66

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances present in this material and possibly subject to this statute are: Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.05 to 5% Ammonia [CAS No. = 7664-41-7] concentration: 0 to 0.9%.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactive, & Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.05 to 5% Ethylene or Ethene [CAS No. 74-85-1] concentration: 1 to 5% Propylene or Propene [CAS No. 115-07-1] concentration: 1 to 10%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which might be present in this material and are subject to this statute are: Hydrogen sulfide [CAS No. = 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.05 to 5% Ammonia [CAS No. = 7664-41-7] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 0.9%.
CWA	This material might be classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not may contain any chemical substance which is known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": Ethylene (Ethene), Propylene (Propene), 1-Butene, and Isobutylene. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in this material which are subject to this statute include: Hydrogen sulfide, Ammonia, Hydrogen, Methane, Ethane, Ethylene (Ethene), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, and n-Butane.

Sour Refinery Gases (C1-C4 Hydrocarbons)**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 7.0
Revision Date 10/15/2002
Print Date Printed on 10/15/2002.

ABBREVIATIONS

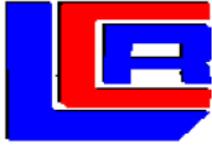
AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
IARC: International Agency for Research on Cancer NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System
NFPA: National Fire Protection Association EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0019
Revision Date 10/11/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquefied Gas.		
Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure.

DANGER! Extremely flammable and poisonous gas/liquid;
vapor may cause flash fire or explosion.
High pressure and rapid diffusion hazard.
High vapor concentrations reduce oxygen available for breathing.
Contains Hydrogen Sulfide (H₂S) and Ammonia.
May be harmful or fatal if inhaled or absorbed through the skin.
May cause central nervous system (CNS) depression
or suffocation.
Compressed gas/liquid contact may cause frostbite/freeze burns.
Mist or vapor may cause mild to severe eye, skin, mucous
membrane, and respiratory tract irritation and inflammation.
Aspiration into the lungs will cause pulmonary edema and
chemical pneumonia.
Overexposures may cause central nervous system (CNS)
depression and other target organ effects.
Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats).
Corrosive to some metals.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110019	Medical Emergency	(918) 495-4700
CAS Number	68783-07-3	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Sour Hydrocarbon Gas Mixture		
Synonyms	Sour Refinery Gas; Mixture of Light Ends Fractionator (LEF) Gases; Refinery Blend Gases (Petroleum); Gas Blend containing Hydrogen, Hydrogen Sulfide and Mercaptans; C1-C4 Hydrocarbons, H ₂ , H ₂ S, and R-SHs.		

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Refinery Blend Gases (Petroleum)	68783-07-3	100
2) Hydrogen sulfide	7783-06-4	0.001-10
3) Ammonia	7664-41-7	0.1-3
4) Hydrogen	1333-74-0	10-50
5) Methane	74-82-8	10-30
6) Ethane	74-84-0	10-20
7) Ethylene	74-85-1	1-5
8) Propane	74-98-6	10-30
9) Propylene	115-07-1	1-5
10) Isobutane	75-28-5	1-5
11) Butenes or Butylenes	25167-67-3	0.1-3
12) n-Butane	106-97-8	10-40

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact. Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. **Ammonia** vapors may cause severe lung effects which might be delayed in onset. Symptoms are characterized by coughing, choking, or shortness of breath. NIOSH has determined that atmospheres containing 100 ppm or more of **hydrogen sulfide (H₂S)** are immediately dangerous to life and health. At concentrations above 500 ppm, **H₂S** cause unconsciousness and respiratory paralysis leading to coma and/or death. Also, NIOSH has determined that atmospheres containing 300 ppm or more of **ammonia (NH₃)** are immediately dangerous to life and health. (See Section 11.)

Additionally, at least one component of this gas/liquid mixture is a "simple asphyxiant". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.

Breathing high concentrations of the liquid-phase vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes.

Eye Contact

Vapors may cause mild to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentration of **hydrogen sulfide and ammonia** and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Direct liquid contact can cause clouding of the cornea with small areas of superficial corneal necrosis.

Direct liquid contact may cause eye irritation and clouding of the cornea with small areas of superficial corneal necrosis upon short-term exposure and can produce severe, and possibly permanent, tissue damage if not promptly removed. The severity of the effects depend on the concentration of the **ammonia** component and how soon after exposure the eyes are washed.

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

Skin Contact

May be moderately irritating or corrosive to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solution (0.04 wt.% ammonia) to minutes with more concentrated solutions. Prolonged or repeated contact, even to **dilute concentrations of ammonia solutions**, may cause some degree of permanent tissue destruction.

Direct contact with a liquefied/pressurized gas portion of this material may produce severe and possibly permanent skin damage from frostbite or freeze burns. Tests on this material's components suggest that moderate to severe skin irritation, inflammation, and blistering is expected to occur upon short-term liquid contact. **Hydrogen sulfide** may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases.

Ingestion

Ingestion of this material is highly unlikely due to its volatile nature. However, if swallowed, this material may cause gastrointestinal tract irritation, nausea, and vomiting, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon the **ammonia** concentration, ulceration of the gastrointestinal tract may also occur. Additional central nervous system (CNS) effects may occur prior to the onset of convulsions, coma, and death.

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.

Chronic Health Effects Summary

Subchronic exposure to low levels of **hydrogen sulfide** can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.

Chronic dyspnea, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several workers two years after their occupational overexposures to mists or aerosols of **ammonia**. Also, when ingested by rats, **aqueous ammonia solutions** have been shown to cause gastrointestinal tract tumors.

Chronic inhalation to components of this material (**propane, propylene, isobutane, and n-butane**) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of **epinephrine (adrenaline)-like drugs**. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing eye, skin, cardiac, pulmonary, liver, kidney, or neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics, anemics, and those with reduced pulmonary function, may be more sensitive to excess concentrations of this material's components. They should take additional precautions to minimize or avoid exposure.

Target Organs

This material is toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, blood, and possibly, the endocrine and reproductive systems.

Carcinogenic Potential

This material does not contain any components at concentrations above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP.

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Be particularly careful to clean folds, crevices, creases, and groin area. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.</p> <p>Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a dilute solution of boric acid or acetic acid.</p> <p>This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas and Liquefied Gas.		
Flash Point Method	CLOSED CUP: AP -107° to -73°C (-160° to -100°F). (Estimated)		
Lower Flammable Limit	1.6 to 4.0%	Upper Flammable Limit	AP 45%
Autoignition Temperature	260° to 288°C (500° to 550°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans.		

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas/Liquid Mixture! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. Cover spill with a vapor-suppressing foam as soon as possible. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off.

SECTION 7: HANDLING AND STORAGE

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

Handling

Danger! Corrosive or Irritating Liquid and/or Poisonous and Flammable Gas! Do NOT breathe mist or vapor; it may contain hydrogen sulfide (H₂S), ammonia (NH₃), and/or simple asphyxiants. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where hydrogen sulfide and/or ammonia are routinely stored or handled, install monitoring equipment or system with alarms and special ventilation will be required.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

Hand Protection	Avoid skin contact and use gloves (e.g. disposable neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this gas/liquid mixture may create flammable, explosive, corrosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Air purifying respirators offer no protection against hydrogen sulfide, ammonia, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 5 (ppm) from ACGIH (TLV) [Proposed]
2) Ammonia	TWA: 10 STEL: 20 (ppm) from OSHA (PEL) TWA: 25 STEL: 35 (ppm) from ACGIH (TLV) TWA: 50 STEL: 35 (ppm) from OSHA (PEL) STEL: 35 (ppm) from OSHA (PEL) [Proposed]
3) Hydrogen	Simple asphyxiant.
4) Methane	Simple asphyxiant.
5) Ethane	Simple asphyxiant.
6) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
7) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
8) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas.	Color Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure.
Specific Gravity	0.30 to 0.59 (Water = 1)	pH In the presence of moisture, H ₂ S can convert to H ₂ SO ₄ .	Vapor Density	0.55 to 2.0 (Air = 1)
Boiling Point/Range	-253°C to -1°C (-423° to 31°F) [ASTM D-2887]		Melting/Freezing Point	-259° to -139°C (-435° to -217°F) at 14.7 psia.
Vapor Pressure	200 to 400 psia at 100°F.		Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Moderately soluble in cold water.		Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Hydrogen Sulfide and Ammonia Content = 0.1 to 13 Wt.%; Alkane, Isoparaffin, Alkene, and Cycloalkane Hydrocarbons Content = 87 to 99.9 Wt.% [ASTM D-1319]; Average Density at 60°F = AP 4.50 lbs./gallon [ASTM D-2161].			

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, calcium hypochlorite, chlorates, permanganates, nitrates, hydrogen peroxide, mercury oxide, and oxygen. Oxidizer mixtures and alkane hydrocarbons and chlorine gas mixtures have produced explosions. Under some conditions, mercaptans may react with water or steam to produce additional toxic and flammable vapors.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data	<p>Hydrogen sulfide:</p> <p>GAS (TC_{Lo}): Acute: 10 ppm for 15 minutes (Human) - Eye irritation.</p> <p>GAS (TC_{Lo}): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation.</p> <p>GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death.</p> <p>GAS (LC_{Lo}): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.</p> <p>Ammonia:</p> <p>ORAL (LD_{Lo}): Acute: 132 mg/kg [Human].</p> <p>ORAL (TD_{Lo}): Acute: 15 uL/kg [Human] - Structural changes in the esophagus.</p> <p>GAS (TC_{Lo}): Acute: 20 ppm for 1hour [Human] - Eye irritation, ulcerated nasal septum, and structural changes in the trachea or bronchi.</p> <p>GAS (LC_{Lo}): Acute: 5,000 ppm for 5 minutes [Human].</p> <p>GAS (LC_{Lo}): Acute: 5,000 ppm for 5 minutes [Guinea Pig].</p> <p>GAS (LC₅₀): Acute: 2,000 ppm for 4 hours [Rat].</p> <p>GAS (LC₅₀): Acute: 7,000 mg/m³ for 1 hour [Cat and Rabbit] - Excitement and flaccid paralysis without anesthesia.</p> <p>GAS (LC₅₀): Acute: 4,230 ppm for 1 hour [Mouse] - Ataxia, tremors, and convulsions.</p>
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Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (> 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Ammonia is a strong base and forms **ammonium hydroxide** upon contact with water. This material is corrosive to many organic compounds. If ingested, ammonia can cause severe pain, bloody diarrhea, cardiovascular collapse, and death. Concentrated ammonia is a strong corrosive which can cause burns of the following types: cryogenic from contact with refrigerated liquid, thermal from exothermic reaction with water, and chemical from its alkalinity. It gelatinizes the tissue, forming deep and painful lesions. At low concentrations, aqueous ammonia is a moderate to strong irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. Its effects on the lungs can be severe and delayed in onset; respiratory support may be required following acute inhalation. However, there seems to be a wide variability in the human sensitivity to ammonia.

Chronic dyspnea, restrictive lung dysfunction, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several employees two years after their occupational overexposures to mists and aerosols of ammonia. An aqueous ammonia solution caused

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

gastrointestinal cicatrical tumors in rats following a 24-week feeding assay. NH₃ produced a positive mutagenic response in the Ames Assay and caused chromosomal aberrations during a 16-week cytogenic study using rats. However, in general, pH alterations produce false positive results in short-term genetic assays.

Propylene:

GAS (LC₅₀): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse].

GAS (TC_{Lo}): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.

Iso-Butane:

GAS (TC_{Lo}): Acute: 1,040,000 mg/m³ for 2 hours [Mouse] - Excitment.

GAS (LC₅₀): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

Iso-Butene (Isobutylene or 2-Methylpropene):

GAS (LC₅₀): Acute: 415,000 mg/m³ for 2 hours [Mouse].

GAS (LC₅₀): Acute: 620,000 mg/m³ for 4 hours [Rat].

n-Butane:

GAS (LC₅₀): Acute: 660,000 mg/m³ for 4 hours [Rat].

GAS (LC₅₀): Acute: 680,000 mg/m³ for 2 hours [Mouse].

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol. % in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause redding of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to **propylene** may entail a possible hazard from the formation of a reactive metabolite, **propylene oxide**, which is a "suspect human carcinogen". However, propylene have not been shown to be carcinogenic in rat studies. For example, propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. **Propylene** is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane and n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylene** (additive effect), than the degree of narcosis

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **hydrogen sulfide and ammonia** components of this material may contribute to generation of atmospheric smog. The atmospheric half-life of **propane** under photochemical smog conditions are estimated to be between 5 to 8 hours. The atmospheric half-lives of **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **propane, isobutane, and n-butane** in air (< 8%) are not considered environmentally significant.

Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.

Environmental Fate **Refined liquefied petroleum hydrocarbon gases** are essentially insoluble in water (< 0.1%); however, **hydrogen sulfide** is moderately soluble in water so this material and any contaminated soil or water may be hazardous to human, animal, and aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas/liquid to the atmosphere should be avoided. Maximize material recovery for reuse or recycling.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitability (D001) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation (DOT) regulated material.		
Proper Shipping Name	Compressed gases, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Hydrogen)		
Hazard Class	DOT Class: 2.3 (Poisonous gas) and 2.1 (Flammable gas).	Packing Group(s) UN/NA ID	Not applicable. UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Hydrogen sulfide and Ammonia .		

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)

Placards


Emergency Response Guide No.	119
HAZMAT STCC No.	49 057 66
MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances which are present in this material and subject to this statute are: Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.01 to 8% Ammonia [CAS No. = 7664-41-7] concentration: 0.1 to 2%.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactive, & Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.01 to 8% Ammonia [CAS No. = 7664-41-7] concentration: 0.1 to 2% Ethylene or Ethene [CAS No. 74-85-1] concentration: 1 to 5% Propylene or Propene [CAS No. 115-07-1] concentration: 1 to 5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which might be present in this material that are subject to this statute are: Hydrogen sulfide [CAS No. = 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.01 to 8% Ammonia [CAS No. = 7664-41-7] (RQ = 100 lbs. [45.36 kg]) conc.: 0.1 to 2%.
CWA	This material might be classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not may contain any chemical substance which is known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": Ethylene (Ethene), Propylene (Propene), 1-Butene, and Isobutylene. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in this material which are subject to this statute include: Hydrogen sulfide, Ammonia, Hydrogen, Methane, Ethane, Ethylene (Ethene), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, and n-Butane.

Hydrogen-Rich, Sour Refinery Gases (C1-C4 Hydrocarbons)**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 5.0
Revision Date 10/11/2002
Print Date Printed on 10/15/2002.

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
IARC: International Agency for Research on Cancer NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System
NFPA: National Fire Protection Association EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0022
HFR#441

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0022
Revision Date 6/13/2006

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Gas.
Color Colorless to light yellow.
Odor Hydrocarbon. Rotten eggs. (Strong.)

DANGER!

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

**Contains Hydrogen Sulfide Gas!
Harmful to aquatic organisms.**

Protective Equipment

**Minimum Recommended
See Section 8 for Details**

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Vent Waste Sour Gas (C1-C6 Hydrocarbons)	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	68814-47-1	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Sour Gas		
Synonyms	Refinery Vent Waste Gas Mixture, Refinery Gas Mixture, Untreated Low-Pressure (Low-Line) Gas, Low-Line Gathering System Gas, Untreated Fuel Gas, C1-C6 Hydrocarbons with Hydrogen Sulfide.		

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

SECTION 2. COMPOSITION (TYPICAL)

Component Name(s)	CAS Registry No.	Concentration (%)
Propane	74-98-6	15 - 20
Ethane	74-84-0	15 - 20
n-Butane	106-97-8	15 - 20
n-Pentane	109-66-0	10 - 15
Ethylene	74-85-1	2 - 5
Methane	74-82-8	1 - 5
Iso-Butane	75-28-5	1 - 5
Hexane, other isomers	Mixture	1 - 5
n-Hexane	110-54-3	1 - 3
Pentanes, all isomers	Mixture	1 - 3
Propylene	115-07-1	1 - 2
Butenes or Butylenes	25167-67-3	0.5 - 1.5
Hydrogen sulfide	7783-06-4	0.4 - 1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled. Contains hydrogen sulfide. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 to 1000 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death.

Inhalation of gas or vapor may cause respiratory paralysis, severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath.

Additionally, one or more components of this gas mixture is a "simple asphyxiant". High concentrations of this gas can displace the amount of oxygen available to breathe below that level necessary to sustain life. Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, weakness, nausea, vomiting, loss of coordination, unconsciousness, and coma, depending upon the concentration level and duration of exposure.

Eye Contact

Vapors may cause eye irritation and light sensitivity. Severity depends upon the concentration and duration of exposure.

Skin Contact

Direct contact with an expanding gas may produce skin damage from frostbite or freeze burns. Skin absorption of hydrogen sulfide appears to be minimal in humans.

Ingestion

Ingestion is not an applicable route of exposure for gases.

Chronic Health Effects Summary

Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea.

Conditions Aggravated by Exposure

Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Respiratory System, Central Nervous System (CNS), Heart (Cardiac)

Target Organs

Contains material which may cause damage to the following organs: mucous membranes, heart, skin, central nervous system (CNS), eye, lens or cornea.

Carcinogenic Potential

This product is not known to contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).			
OSHA Health Hazard Classification		OSHA Physical Hazard Classification	
Irritant <input checked="" type="checkbox"/>	Sensitizer <input type="checkbox"/>	Combustible <input type="checkbox"/>	Explosive <input checked="" type="checkbox"/>
Toxic <input type="checkbox"/>	Highly Toxic <input type="checkbox"/>	Flammable <input checked="" type="checkbox"/>	Oxidizer <input type="checkbox"/>
Corrosive <input type="checkbox"/>	Carcinogenic <input type="checkbox"/>	Compressed Gas <input type="checkbox"/>	Organic Peroxide <input type="checkbox"/>
			Pyrophoric <input type="checkbox"/>
			Water-reactive <input type="checkbox"/>
			Unstable <input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If tissue is frozen, immediately seek medical attention. If tissue is not frozen, check for and remove contact lenses. Then, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure luke warm water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible. Do not use eye ointment unless directed by a physician.
Skin Contact	In the event of frostbite or freeze burn, the affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water. Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	<p>INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.</p> <p>This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.</p> <p>Treat symptomatically.</p>

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.
Flash Point	Open cup: <-45°C (-49°F).
Lower Flammable Limit	AP 1 %
Upper Flammable Limit	AP 13 %
Autoignition Temperature	The lowest known value is 430°C (806°F) (Butane, all isomers).

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

SECTION 7. HANDLING AND STORAGE

Handling DANGER: Poisonous and Flammable Gas. Do NOT breathe vapor; it contains hydrogen sulfide (H₂S). This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow escaping material to contact eyes or skin. Wear appropriate respiratory protection, protective work clothing, eye and face protection when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. Empty containers may still contain flammable and poisonous residue.

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

Store sample cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F (38° C). Protect from dampness, salt or corrosive chemicals.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may be required in work areas to prevent accumulation of mixtures of gas and air that may ignite with explosive force. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling sampling cylinders, pressurized containers and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use neoprene or PCV/nitrile gloves. When handling materials that can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.

Respiratory Protection

A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments

Releases of this gas may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency, flammability and toxic gas levels. Odor is NOT adequate to warn of hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

Propane	ACGIH (United States). TWA: 2500 ppm 8 hour(s).
	OSHA (United States). TWA: 1000 ppm 8 hour(s).
	Simple asphyxiant.
Ethane	Simple asphyxiant.
n-Butane	ACGIH (United States). TWA: 800 ppm 8 hour(s).
n-Pentane	ACGIH (United States, 1998). TWA: 600 ppm
	OSHA (United States, 1976). TWA: 1000 ppm
Ethylene	Simple asphyxiant.
Methane	Simple asphyxiant.
Iso-Butane	ACGIH (United States). TWA: 800 ppm 8 hour(s).
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s).
	STEL: 1000 ppm 15 minute(s).
n-Hexane	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s).
	OSHA (United States). TWA: 500 ppm 8 hour(s).
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s).
	OSHA (United States). TWA: 1000 ppm 8 hour(s).
Propylene	Simple asphyxiant.
Butenes or Butylenes	Not available.
Hydrogen sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s).
	STEL: 15 ppm 15 minute(s).
	OSHA (United States). CEIL: 20 ppm 8 hour(s).
	STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas.	Color	Colorless to light yellow.	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	0.65 (Water = 1)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	-12°C (10.4°F)			Melting/Freezing Point	-160°C (-256°F)
Vapor Pressure	Not applicable.			Volatility	650 g/l VOC (w/v)
Solubility in Water	Partially soluble in cold water.			Viscosity (cSt @ 40°C)	not available
Flash Point	Open cup: <-45°C (-49°F).				
Additional Properties	No additional information.				

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data	<p>Propane Studies in laboratory animals indicate exposure to extremely high levels of propane (1 to 10 vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.</p> <p>n-Butane INHALATION (LC50): Acute: 660000 mg/m³ 4 hour(s) [Rat]. 680000 mg/m³ 2 hour(s) [Mouse]. An n-butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Also, butane may decrease the myocardial threshold to epinephrine-induced arrhythmias.</p> <p>n-Pentane n-Pentane was associated with cardiac sensitization in rabbits at a concentration of 100,000 ppm in air within four hours of exposure. Pentane can act as an anesthetic by inhalation. Mice exhibited signs of respiratory irritation and mild central nervous system effects at concentrations of 32,000 to 69,000 ppm for five minutes.</p> <p>n-Hexane This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause permanent peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Co-exposure to methylethyl ketone or methyl isobutyl ketone increases the neurotoxic properties of n-hexane. In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.</p> <p>Pentanes, all isomers Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.</p> <p>Hydrogen sulfide INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse]. Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations above 100 ppm are immediately dangerous to life and health.</p>
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Vent Waste Sour Gas (C1-C6 Hydrocarbons)

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material.
Environmental Fate	An environmental fate analysis has not been conducted on this specific product. Releases are expected to cause significant immediate impact but only localized non-persistent environmental damage.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Material residues may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. If possible and permissible, this material may be disposed of as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Sudden Release of Pressure, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above <i>de minimis</i> levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: n-Hexane [CAS No.: 110-54-3] Concentration: 2%

Vent Waste Sour Gas (C1-C6 Hydrocarbons)

CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: n-Hexane [CAS No.: 110-54-3] RQ = 5000 lb. (2268 kg) Concentration: 2% Hydrogen sulfide [CAS No.: 7783-06-4] RQ = 100 lb. (45.36 kg) Concentration: 0.7%
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This product is not known to contain any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 4.0
Revision Date 6/13/2006
Print Date Printed on 6/13/2006.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0023
HFR# 441

Hydrogen Rich Sour Refinery Gas

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0023
Revision Date 9/6/2006

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	4
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Gas.

Color Colorless to light yellow. **Odor** Hydrocarbon. Rotten eggs. (Strong.)

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source. Contains Hydrogen Sulfide.

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Hydrogen Rich Sour Refinery Gas	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	68783-07-3	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Sour Gas		
Synonyms	Sour Recycle Gas; Recycle Gas from Unit 630		

Hydrogen Rich Sour Refinery Gas

SECTION 2. COMPOSITION (TYPICAL)

All liquid components are listed on a weight % basis while all gases are listed on a mole % basis.

Component Name(s)	CAS Registry No.	Concentration (%)
Hydrogen	1333-74-0	75 - 100
Methane	74-82-8	10 - 40
Ethane	74-84-0	10 - 40
Propane	74-98-6	5 - 35
n-Hexane	110-54-3	5 - 35
Butane, all isomers	106-97-8	5 - 35
n-Heptane	142-82-5	1 - 35
Pentanes, all isomers	Mixture	1 - 35
Hexane, other isomers	Mixture	1 - 5
Ammonia	7664-41-7	1 - 2
Hydrogen sulfide	7783-06-4	0.1 - 1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled. Contains hydrogen sulfide. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 to 1000 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death.

Inhalation of gas or vapor may cause respiratory paralysis, severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath.

Additionally, one or more components of this gas mixture is a "simple asphyxiant". High concentrations of this gas can displace the amount of oxygen available to breathe below that level necessary to sustain life. Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, weakness, nausea, vomiting, loss of coordination, unconsciousness, and coma, depending upon the concentration level and duration of exposure.

Eye Contact

Vapors may cause eye irritation and light sensitivity. Severity depends upon the concentration and duration of exposure.

Skin Contact

Direct contact with an expanding gas may produce skin damage from frostbite or freeze burns. Skin absorption of hydrogen sulfide appears to be minimal in humans.

Ingestion

Ingestion is not an applicable route of exposure for gases.

Chronic Health Effects Summary

Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea.

Conditions Aggravated by Exposure

Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Respiratory System, Central Nervous System (CNS), Heart (Cardiac)

Target Organs

Contains material which may cause damage to the following organs: mucous membranes, heart, skin, central nervous system (CNS), eye, lens or cornea.

Carcinogenic Potential

This product is not known to contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

Hydrogen Rich Sour Refinery Gas

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If tissue is frozen, immediately seek medical attention. If tissue is not frozen, check for and remove contact lenses. Then, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure luke warm water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible. Do not use eye ointment unless directed by a physician.
Skin Contact	In the event of frostbite or freeze burn, the affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water. Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	<p>INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.</p> <p>This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.</p> <p>Treat symptomatically.</p>

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.
Flash Point	Open cup: <-45°C (-49°F).
Lower Flammable Limit	AP 1 %
Upper Flammable Limit	AP 13 %
Autoignition Temperature	The lowest known value is 430°C (806°F) (Butane, all isomers).

Hydrogen Rich Sour Refinery Gas

Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

SECTION 7. HANDLING AND STORAGE

Handling DANGER: Poisonous and Flammable Gas. Do NOT breathe vapor; it contains hydrogen sulfide (H₂S). This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow escaping material to contact eyes or skin. Wear appropriate respiratory protection, protective work clothing, eye and face protection when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. Empty containers may still contain flammable and poisonous residue.

Hydrogen Rich Sour Refinery Gas

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

Store sample cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F (38° C). Protect from dampness, salt or corrosive chemicals.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

- Engineering Controls** Local exhaust and general room ventilation may be required in work areas to prevent accumulation of mixtures of gas and air that may ignite with explosive force. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.
- Personal Protective Equipment** Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.
- Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



- Eye Protection** Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling sampling cylinders, pressurized containers and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
- Hand Protection** Use neoprene or PCV/nitrile gloves. When handling materials that can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves.
- Body Protection** Prevent potential skin contact with cold liquid or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Releases of this gas may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency, flammability and toxic gas levels. Odor is NOT adequate to warn of hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

Hydrogen Rich Sour Refinery Gas

Hydrogen	Simple asphyxiant.
Methane	Simple asphyxiant.
Ethane	Simple asphyxiant.
Propane	ACGIH (United States). TWA: 2500 ppm 8 hour(s).
	OSHA (United States). TWA: 1000 ppm 8 hour(s).
	Simple asphyxiant.
Butane, all isomers	ACGIH (United States). TWA: 800 ppm 8 hour(s).
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s).
	OSHA (United States). TWA: 1000 ppm 8 hour(s).
n-Heptane	OSHA (United States). TWA: 500 ppm
	ACGIH (United States). TWA: 400 ppm STEL: 500 ppm
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
Ammonia	Not available.
Hydrogen Sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s).
	OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Sour Gases (family)	Not available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas.	Color	Colorless to light yellow.	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	0.65 (Water = 1)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	-12°C (10.4°F)			Melting/Freezing Point	-160°C (-256°F)
Vapor Pressure	Not applicable.			Volatility	650 g/l VOC (w/v)
Solubility in Water	Partially soluble in cold water.			Viscosity (cSt @ 40°C)	not available
Flash Point	Open cup: <-45°C (-49°F).				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong oxidizers.		

Hydrogen Rich Sour Refinery Gas

Hazardous Decomposition Products

No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Propane:

Studies in laboratory animals indicate exposure to extremely high levels of propane (1 to 10 vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

n-Hexane:

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause permanent peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Co-exposure to methylethyl ketone or methyl isobutyl ketone increases the neurotoxic properties of n-hexane. In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.

Butane, all isomers

Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

n-Heptane:

n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

Pentanes, all isomers

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Hydrogen Sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse]. Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations at or above 100 ppm are immediately dangerous to life and health.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material.

Environmental Fate

An environmental fate analysis has not been conducted on this specific product. Releases are expected to cause significant immediate impact but only localized non-persistent environmental damage.

Hydrogen Rich Sour Refinery Gas

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Material residues may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. If possible and permissible, this material may be disposed of as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory

This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.

SARA 302/304 Emergency Planning and Notification

The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

SARA 311/312 Hazard Identification

The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

fire, Sudden Release of Pressure, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard

SARA 313 Toxic Chemical Notification and Release Reporting

This product contains the following components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:

n-Hexane [CAS No.: 110-54-3] Concentration: 20%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:

n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: 20%

Hydrogen sulfide [CAS No.: 7783-06-4] RQ = 100 lbs. (45.36 kg) Concentration: 0.55%

Clean Water Act (CWA)

Hydrogen Rich Sour Refinery Gas

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

**California
Proposition 65**

This product is not known to contain any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.

**New Jersey
Right-to-Know Label**

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

**Additional Regulatory
Remarks**

No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 5.0
Revision Date 9/6/2006
Print Date Printed on 9/6/2006.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0025
Revision Date 11/21/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquefied Gas		
Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Odorless to faint, unpleasant to strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure.

DANGER! Extremely flammable and potentially
poisonous gas/liquid; vapor may cause flash fire
or explosion.

High pressure and rapid diffusion hazard.

High concentrations of vapor reduce oxygen available
for breathing.

May contain Hydrogen Sulfide (H₂S).

May be corrosive to some metals.

May cause central nervous system (CNS) depression
or suffocation.

Liquid or compressed gas contact may cause frostbite
or freeze burns.

Vapor or mist may cause mild to severe eye, mucous membranes,
skin, and respiratory tract irritation and inflammation.

May be harmful or fatal if inhaled or absorbed through the skin.

Overexposures may cause target organ effects such as lung,
brain, liver, and/or kidney damage.

Prolonged and/or repeated inhalation may increase the
heart's susceptibility to arrhythmias (irregular beats).

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 3	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111111146	Medical Emergency	(918) 495-4700
CAS Number	Mixture—See Section 2.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Hydrogen plus Alkane and Isoparaffin Hydrocarbons		
Synonyms	Low Line Gas; Mixing Pot Gas; Hydrogen and C1-C6 Alkane and Isoparaffin Hydrocarbons Mixture.		

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)**SECTION 2: COMPOSITION**

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrogen	1333-74-0	1-40
2) Methane	74-82-8	10-50
3) Ethylene	74-85-1	1-10
4) Ethane	74-84-0	10-50
5) Propylene	115-07-1	1-5
6) Propane	74-98-6	5-40
7) Iso-Butane	75-28-5	5-30
8) n-Butane	106-97-8	1-25
9) Iso-Pentane	78-78-4	1-20
10) n-Pentane	109-66-0	1-15
11) Hexane Isomers	Mixture	0.1-5
12) Nitrogen	7727-37-9	0-1.5
13) Hydrogen sulfide	7783-06-4	0.0001-0.1

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact. Eye contact.

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)</p> <p>Additionally, several components of this gas/liquid mixture are "simple asphyxiants" (see Section 8). High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Breathing vapors may also cause central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure.</p>
Eye Contact	<p>Vapors may cause mild to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and duration of exposure. Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Direct liquid contact can cause clouding of the cornea with small areas of superficial corneal necrosis.</p>
Skin Contact	<p>Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Hydrogen sulfide can be absorbed through the skin to produce toxic effects. Tests on this stream's components suggest that the liquid form may cause mild to moderate skin irritation and inflammation.</p>
Ingestion	<p>Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus or be aspirated into the lungs. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.</p>

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

Chronic Health Effects Summary Subchronic exposure to low levels of **hydrogen sulfide** can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.)

Chronic inhalation to components of this liquefied gas (**propane, n-butane, and n-pentane**) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of **epinephrine (adrenaline)**-like drugs.

Conditions Aggravated by Exposure Personnel with pre-existing chronic respiratory diseases, nervous system disease, psychological conditions, high blood pressure, cardiovascular conditions, and eye or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.

Target Organs These streams are toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, and possibly, the liver, kidneys, and reproductive systems.

Carcinogenic Potential This material does not contain any components at concentrations above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
- Skin Contact** The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
- Ingestion** Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

Notes to Physician

Nitrite as an antidote for acute **hydrogen sulfide** intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.

If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines and other sympathomimetic drugs such as epinephrine (adrenaline) should be reserved for emergency situations and then used only with special precaution.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point Method	CLOSED CUP: < -60°C (-76°F) [Estimated].		
Lower Flammable Limit	0.9 to 1.4%	Upper Flammable Limit	7 to 44%
Autoignition Temperature	260° to 460°C (500° to 860°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, unburned hydrocarbons, and oxides of sulfur.		
Special Properties	This gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it may contain **hydrogen sulfide (H₂S)**. This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



- Eye Protection** Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gases. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
- Hand Protection** Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.
- Body Protection** Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
- Respiratory Protection** Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against **oxygen deficiency, hydrogen sulfide, and simple asphyxiants**. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).
- General Comments** Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency, hydrogen sulfide concentration, and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen	Simple asphyxiant.
2) Nitrogen	Simple asphyxiant.
3) Methane	Simple asphyxiant.
4) Ethane	Simple asphyxiant.
5) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
6) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
7) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
8) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
9) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
10) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 5 (ppm) from ACGIH (TLV) [Proposed] TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL)

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas	Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Odorless to faint, unpleasant to strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure.
Specific Gravity	AP 0.38 to 0.55 (Water = 1)	pH	Not applicable.	Vapor Density	AP 0.5 to 1.0 (Air = 1)
Boiling Point/Range	AP -253° to 63°C (-423° to 146°F) at 14.7 psia [ASTM D-2887]			Melting/Freezing Point	AP -260° to -83°C (-435° to -117°F) at 14.7 psia
Vapor Pressure	AP 50 to 250 psia at 40°C (104°F)			Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Slightly soluble in cold water.			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = 21,500 to 22,000 Btu/lb or 1,000 to 2,500 Btu/cu.ft.; Dry Point Temperature = AP 140°F (60°C) [ASTM D-86]; Average Density at 60°F = < 5.0 lbs./gal. [ASTM D-2161].				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur, but possible.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Hydrogen sulfide: GAS (TCLo): Acute: 10 ppm for 15 minutes (Human) - Eye irritation. GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation. GAS (LC100): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death. GAS (LCLo): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.</p> <p>Iso-Butane: GAS (TCLo): Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement. GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p> <p>n-Butane: GAS (LC50): Acute: 658,000 mg/m³ for 4 hours [Rat]. GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse].</p> <p>n-Pentane: GAS (LC50): Acute: 364,000 mg/m³ for 4 hours [Rat] - Excitement. INTRAVENOUS (LD50): Acute: 446 mg/kg [Mouse].</p>
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Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (> 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to **propylene** may entail a possible hazard from the formation of a reactive metabolite, **propylene oxide**, which is a "suspect human carcinogen". However, propylene have not been shown to be carcinogenic in rat studies. For example, propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. **Propylene** is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane and n-butane** for periods of 8 hours daily for 10 days to 14 days. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylene** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic.

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)**SECTION 12: ECOLOGICAL INFORMATION**

Ecotoxicity Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **hydrogen sulfide** component of this material may contribute to generation of atmospheric smog. If released, the atmospheric half-life of **propane** under photochemical smog conditions is estimated to be between 5 to 8 hours. The atmospheric half-lives of **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **propane, isobutane, and n-butane** in air (LT 8%) are not considered to be environmentally significant.

Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time. The **pentanes and hexane isomers** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present.

Environmental Fate If spilled, the **liquefied petroleum hydrocarbon gases** are only slightly soluble in water (LT 0.1%); but, the toxic **hydrogen sulfide** is moderately soluble in water. This liquefied stream, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas/liquid to the atmosphere should be avoided. Maximize material recovery for reuse or recycling. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation (DOT) regulated material.		
Proper Shipping Name	Compressed gases, flammable, n.o.s. (Methane, Ethane) or Compressed gases, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Methane and/or Ethane)		
Hazard Class	DOT Class: 2.1 (Flammable gas) or possibly 2.3 (Poisonous gas).	Packing Group(s) UN/NA ID	Not applicable. UN1954 or UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance component that might be present in this material which requires DOT HAZMAT bill-of-lading display is Hydrogen sulfide .		

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)

Placards



Emergency Response Guide No.	115 or 119
HAZMAT STCC No.	49 057 29 or 49 057 66
MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	These streams and/or their components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance present in this material subject to this statute is: Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.0001 to 0.1%.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which are at or above de minimis levels and listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Ethylene or Ethene [CAS No. 74-85-1] concentration: 1 to 10% Propylene or Propene [CAS No. 115-07-1] concentration: 1 to 5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance that might be present in this material which is subject to this statute is: Hydrogen sulfide [CAS No. = 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.0001 to 0.1%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not may contain any chemical substance which is known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component in this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare": Ethylene (Ethene), Propylene (Propene), Isopentane, and n-Pentane. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this product which are subject to this statute are: Hydrogen, Methane, Ethane, Ethylene (Ethene), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), Butane, Isopentane (Butane, 2-methyl), n-Pentane, 2,2-Dimethylpropane (Neopentane), and Hydrogen Sulfide.

Mixed Refinery Gases With Hydrogen (C1-C6 Hydrocarbons)**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 4.0
Revision Date 11/21/2002
Print Date Printed on 11/21/2002.

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
IARC: International Agency for Research on Cancer NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System
NFPA: National Fire Protection Association EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

HoustonRefining

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Olefins Plant Feed - 730°EP (OP-730)

RS 0026
HFR# 220
Formerly
AP2560**Company**Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583**Material Safety Data Sheet**MSDS No. ~~AP2560~~
Revision Date 11/01/06**IMPORTANT:** Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.**Emergency Overview**

Physical State	Liquid.		
Color	Transparent to slightly opaque; slightly pale to yellow	Odor	Characteristic, kerosene-like

WARNING! Combustible liquid; vapor may cause flash fire. Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.

Liquid contact may cause minimal to mild eye and/or moderate to severe skin irritation and inflammation.

Based upon laboratory animal studies, may cause skin cancer following extended contact.

May be harmful if inhaled or absorbed through the skin. Overexposures may cause central nervous system (CNS) depression and/or other target organ effects.

May be harmful or fatal if ingested.

Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia.

Based upon animal testing, may adversely affect reproduction. Spills may create a slipping hazard.

If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects.

Hazard Rankings

	HMS	NFPA
Health Hazard	* 2	0
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

Protective EquipmentMinimum Requirements
See Section 8 for Details**SECTION 1: IDENTIFICATION****Trade Name** Olefins Plant Feed - 730°EP (OP-730)**Product Number** 3737437374**CAS Number** 84742-80-9**Product Family** Petroleum Hydrocarbon Middle Distillate(s)

Synonyms OPF-730EP, Heavy Olefins Plant Feedstock; Steam Cracker Feed, Hydrodesulfurized (HDS) Catalytically Cracked and/or Middle Distillates (Petroleum), Hydrodesulfurized Medium Distillate and/or HDS Light Gas Oil; HDS Middle Distillate, Hydrodesulfurized Diesel, HDS Diesel Oil (Heavy), Diesel Distillate from an HDS Unit, C9-C25 Petroleum Hydrocarbons

Business ContactProduct Safety 800-700-0946
24 Hour Emergency Contact
CHEMTREC 800-424-9300
CANUTEC-Canada 613-996-6666
LYONDELL 800-245-4532

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SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrodesulfurized Middle Distillate (Petroleum)	64742-80-9	25-100
2) Hydrodesulfurized Light Catalytic Cracked Distillate (Petroleum)	68333-25-5	0-75
3) Nonanes	Mixture	1-10
4) Trimethylbenzene (mixed isomers)	25551-13-7	0.5-1.5
5) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-3
6) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	35-70
7) Naphthalene	91-20-3	1-3
8) C10-C11 Alkylbenzenes	70683-06-0	1-10
9) Biphenyl (Diphenyl)	82-52-4	0.5-1.5
10) C12-C23 Aromatic Hydrocarbons	Mixture	5-15
11) C13-C25 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	15-25

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this product can cause minimal to mild eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials suggest that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. This hydrodesulfurized mixture is a middle distillate similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced. Based upon animal testing, the C9 aromatic hydrocarbon components (trimethylbenzenes and ethylmethylbenzenes) are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period. Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results.

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Olefins Plant Feed - 730°EP (OP-730)

Biphenyl (Diphenyl) may cause liver and/or nerve damage (See Section 11.)

Conditions Aggravated by Exposure	Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases, and women attempting to conceive should avoid exposure
Target Organs	This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the blood, liver, kidneys, and reproductive system
Carcinogenic Potential	This material contains middle distillates at or above a 0.1% concentration and it is considered to be carcinogenic by IARC and OSHA. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification			
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>
						Pyrophoric	<input type="checkbox"/>
						Water-reactive	<input type="checkbox"/>
						Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

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SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-II Combustible Liquid. Highly combustible!		
Flash Point Method	CLOSED CUP 51° to 60°C (125° to 140°F) [Pensky-Martens (ASTM D-93)]		
Lower Flammable Limit	AP 0.6 %	Upper Flammable Limit	AP 7.5 %
Autoignition Temperature	AP 257°C (494°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors		
Special Properties	<p>Combustible Liquid! This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.</p>		
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>		
Protection of Fire Fighters	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.</p>		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

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SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

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Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance

1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)

2) Nonane, all isomers

3) Trimethylbenzene (mixed isomers)

4) Naphthalene

5) Biphenyl (Diphenyl)

Applicable Workplace Exposure Levels

TWA: 100 (mg/m³) from ACGIH (TLV) - SKIN [Proposed]

TWA: 200 (ppm) from ACGIH (TLV)

TWA: 200 (ppm) from OSHA (PEL) [Proposed]

TWA: 25 (ppm) from ACGIH (TLV)

TWA: 25 (ppm) from OSHA (PEL) [Proposed]

TWA: 10 STEL 15 (ppm) from ACGIH (TLV) - SKIN

TWA: 10 STEL 15 (ppm) from OSHA (PEL) [Proposed]

TWA: 10 (ppm) from OSHA (PEL)

TWA: 0.2 (ppm) from ACGIH (TLV)

TWA: 0.2 (ppm) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Transparent to slightly opaque, slightly pale to yellow	Odor	Characteristic, kerosene-like
Specific Gravity	0.84 to 0.88 at 60°F (Water = 1)	pH	Not applicable	Vapor Density	5.0 to 5.2 (Air = 1 at 70°F)
Boiling Point/Range	155° to 388°C (310° to 730°F) (ASTM D-2887)	Melting/Freezing Point	< -25°C (-13°F) (ASTM D-2388)	Viscosity (cSt @ 40°C)	2.5 to 4 (ASTM D-445) and < 8 cSt at -20°C
Vapor Pressure	1.6 to 1.8 mm Hg at 20°C (68°F) or LT 0.1 psi(a) at 100°F (38°C)	Volatility Characteristics		Volatile Organic Compounds (VOCs) Content	= 100%, AP 825 gm/L
Solubility in Water	Negligible to slightly soluble in cold water (0.005 to 0.04%)	Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 86 to 91 Wt % (ASTM D-1319), C9-C24 Aromatic Hydrocarbon Content = 9 to 34 Wt % (ASTM D-1319), Average Density at 60°F = 7.203 lbs/gal. (ASTM D-2161), Cetane Number = > 40 (ASTM D-613) or Cetane Index = GT 42 (ASTM D-976), Saybolt Viscosity = 32 to 38 SUS at 100°F (ASTM D-2161), Sulfur Content = < 0.2 Wt % (by ASTM D-2622) or LT 0.5 Wt % (by ASTM D-129), Ash Content = < 0.01 Wt % (ASTM D-482), Ramsbottom Carbon Residue = LT 0.35 Wt % (ASTM D-524), Evaporation Rate = LT 0.04 when n-Butyl acetate = 1.0.		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	No substances are readily identified from composition, and, no degradation data is available		

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SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrodesulfurized Middle Distillate (Petroleum):

- GAS (LC50) Acute 4.60 to 7.64 mg/L for 4 hours [Rat] - Dyspnea, nasal discharge alopecia, and excess salivation
- ORAL (LD50) Acute >500,000 mg/kg [Rat screen] - Diarrhea, hyperactivity, ptosis, urine-stained stomach, and somnolence
- DERMAL (LD50) Acute >2,000 mg/kg [Rabbit screen]
- BUEHLER DERMAL Acute Non-sensitizing [Guinea Pig]
- INTRAVENOUS (LD50): Acute 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma
- 14-Day DERMAL Subchronic 0.05 ml/kg applied 3 times per week [Mouse, Human skin grafted to Athymic nude Mice] - Irritation and epidermal hyperplasia
- 62-Week DERMAL Chronic 0.05 ml/kg applied 3 times per week [Mouse] - Extreme skin irritation, moderate increase in contact-point skin tumors

n-Nonane:

- GAS (LC50) Acute 3,200 ppm for 4 hours [Rat].
- INTRAVENOUS (LD50) Acute 218 mg/kg [Mouse]

Trimethylbenzenes:

- ORAL (LD50): Acute 8,970 mg/kg [Rat]

Ethylmethylbenzenes (Ethyltoluenes):

- GAS (LC50) Acute 50,000 mg/m³ for 2 hours [Cat].
- GAS (LC50) Acute 54,000 mg/m³ for 4 hours [Mouse]

Naphthalene:

- ORAL (LD50) Acute 490 mg/kg [Rat]
- ORAL (LD50) Acute 533 mg/kg [Mouse]
- ORAL (LD50) Acute 1,200 mg/kg [Guinea Pig]
- SUBCUTANEOUS (LD50) Acute 969 mg/kg [Mouse]
- INTRAVENOUS (LD50) Acute 100 mg/kg [Mouse]
- INTRAPERITONEAL (LD50) Acute 150 mg/kg [Mouse]

Biphenyl (Diphenyl or 1,1'-Biphenyl):

- GAS (TCLo) Acute 4,400 ug/m³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting
- ORAL (LD50) Acute >2,600 mg/kg [Cat screen]
- ORAL (LD50) Acute 2,400 mg/kg [Rat and Rabbit]
- ORAL (LD50) Acute 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea
- DERMAL (LD50) Acute >5,010 mg/kg [Rabbit screen]
- INTRAVENOUS (LD50) Acute 58 mg/kg [Mouse]

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 700°F., commonly referred to as "middle distillates," including both hydrodesulfurized middle distillate and hydrodesulfurized light catalytic cracked distillate have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Hydrodesulfurized middle distillate produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) assay, the in-vivo mouse SCE assay, the in-vitro mouse lymphoma assay without S9 activation, and the in-vivo rat bone marrow cell chromosome aberrations assay, however, the in-vitro mouse lymphoma assay with S9 activation produced a positive response. The significance of these animal study results to human health is unclear.

Studies with mice and rats have shown that some petroleum middle distillate fuels similar to this material have caused liver tumors and kidney damage and/or tumors. However, the kidney effects were sex hormone dependent and not seen in similar studies involving Guinea pigs, dogs, or monkeys. Also, the significance of the liver tumors in rodents is highly speculative relative to humans.

Studies with mice and rats have also shown that chronic exposures (8 hours/day, 7 days/week, for 24 months) to unfiltered diesel fuel exhaust produced lung tumors and lymphomas. On the basis of these studies, NIOSH recommended that complete diesel exhaust be regarded as a "potential carcinogen."

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Olefins Plant Feed - 730^oEP (OP-730)

Numerous epidemiology studies have been carried out to test the hypothesis that lung and/or bladder cancers are associated with chronic exposure to diesel engine exhaust. The most comprehensive case-control and retrospective cohort studies on U S railroad workers showed an increased risk for lung cancer and this risk significantly increased with extended duration exposures. There are some indications that an elevated frequency of bladder cancer amongst bus and truck drivers may be due to diesel engine exhaust exposure.

Rats inhaling n-nonane at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Ethylmethylbenzenes are primary skin irritants and overexposures might cause liver and/or kidney damage or increase blood cholinesterase levels. Inhalation of these and other C9 aromatic hydrocarbons by pregnant mice and rats during gestational days 6 through 15 resulted in decreased fetal and newborn weights.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction of red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in 8 of 21 workers exposed to elevated levels of naphthalene vapors for 5 years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Also, naphthalene may cause fetal toxicity or damage. Laboratory studies produced limited evidence of fetal toxicity in pregnant female mice including decreased spleen weights.

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage. Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this material, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, volatile aromatic hydrocarbon components (trimethylbenzenes, ethylmethylbenzenes, naphthalene, and biphenyl) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalus cephalus*), similar middle distillates and some of this material's components showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 20 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Based upon actual spill incident investigations, similar mixtures have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This material is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

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Olefins Plant Feed - 730*EP (OP-730)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residue at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitability (D001) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Nonanes, Ethylmethylbenzenes and/or Naphthalene); or Combustible liquid, n.o.s. (Petroleum distillates) or (Nonanes, Ethylmethylbenzenes, Naphthalene) in bulk.		
	This material has a flash point temperature of between 100° and 141°F (38° to 60°C). For bulk shipments, it is classified as a DOT "Flammable Liquid". However, according to 49 CFR 173.120(b)(2) and 173.150(f)(1), this material may be reclassified as a "Combustible Liquid" and exempted from certain transportation-related requirements, such as labeling, when shipped in non-bulk "limited-quantity" containers of less than 119 gallons capacity. According to 49 CFR 173.150(f)(2) and (3), this provision does not apply to "limited-quantities" offered for or transported via vessel or aircraft or products which are defined as DOT "Marine Pollutants". It is recommended that "Flammable Liquid" products which are reclassified be so identified on the bill-of-lading as "Combustible liquid, n.o.s. (Petroleum distillates) or (Nonanes, Ethylmethylbenzenes)" with identification number "NA1993".		
Hazard Class	DOT Class 3 (Flammable liquid)	Packing Group(s) UNNA ID	PG III UN1268 or NA1993.
Reportable Quantity	The Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are Naphthalene and Cumene.		
Picards		Emergency Response Guide No. 128	
		HAZMAT STCC No.	49 122 17
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

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Olefins Plant Feed - 730°EP (OP-730)

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Naphthalene [CAS No. 91-20-3] concentration: 1 to 3% Biphenyl (Diphenyl) [CAS No. 92-52-4] concentration: 0.5 to 1.5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Cumene [CAS No. 98-82-8] (RQ = 6000 lbs. [2270 kg]) concentration: 0 to 0.5% Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 3%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which is known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13), this product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of 1,3,5-Trimethylbenzene (Mesitylene) [CAS No. 106-87-8] , this material might be subject to US EPA's one-time only per country export notification requirements. In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": Cumene [CAS No. 98-82-8] and Biphenyl (Diphenyl) [CAS No. 92-52-4].

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Olefins Plant Feed - 730*EP (OP-730)

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HIMS and NFPA Hazard Ratings for this product.

REVISION INFORMATION	Logo and Manufacturer name change.
Version Number	6.1
Revision Date	11/01/06

ABBREVIATIONS

AP	Approximately	EQ	Equal	>	Greater Than	<	Less Than	NA	Not Applicable	ND	No Data	NE	Not Established
ACGIH	American Conference of Governmental Industrial Hygienists							AIHA	American Industrial Hygiene Association				
IARC	International Agency for Research on Cancer							NTP	National Toxicology Program				
NIOSH	National Institute of Occupational Safety and Health							OSHA	Occupational Safety and Health Administration				
NPCA	National Paint and Coating Manufacturers Association							HIMS	Hazardous Materials Information System				
NFPA	National Fire Protection Association							EPA	US Environmental Protection Agency				

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***** END OF MSDS *****

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Olefins Plant Feed - 700°EP (OP-700)

RS0029

HR# 220

Formerly
AP2550

Material Safety Data Sheet

Company

Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

MSDS No. ~~AP2550~~
Revision Date 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid
Color Transparent to slightly opaque, slightly pale to yellow
Odor Characteristic, kerosene-like

WARNING! Combustible liquid; vapor may cause flash fire. Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.
Liquid contact may cause minimal to mild eye and/or moderate to severe skin irritation and inflammation.
Based upon laboratory animal studies, may cause skin cancer following extended contact.
May be harmful if inhaled or absorbed through the skin.
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects.
May be harmful or fatal if ingested.
Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia.
Based upon animal testing, may adversely affect reproduction.
Spills may create a slipping hazard.
If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects.

Hazard Rankings

	HMS	NFPA
Health Hazard	* 2	0
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name Olefins Plant Feed - 700°EP (OP-700)

Product Number 3736837368

CAS Number 64742-80-9

Product Family Petroleum Hydrocarbon Middle Distillate(s)

Synonyms OPF-700EP, Heavy Olefins Plant Feedstock, Steam Cracker Feed, Hydrodesulfurized (HDS) Catalytically Cracked and/or Middle Distillates (Petroleum); Hydrodesulfurized Medium Distillate and/or HDS Light Gas Oil, HDS Middle Distillate, Hydrodesulfurized Diesel, HDS Diesel Oil (Medium), Diesel Distillate from an HDS Unit, C9-C25 Petroleum Hydrocarbons

Business Contact

Product Safety 800-700-0946

24 Hour Emergency Contact

CHEMTREC 800-424-9300

CANUTECC-Canada 613-996-6666

LYONDELL 800-245-4532

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Olefins Plant Feed - 700°EP (OP-700)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrodesulfurized Middle Distillate (Petroleum)	64742-80-9	50-100
2) Hydrodesulfurized Light Catalytic Cracked Distillate (Petroleum)	68333-25-5	0-50
3) Nonanes	Mixture	1-10
4) Trimethylbenzene (mixed isomers)	25551-13-7	0.5-1.5
5) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-3
6) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	60-70
7) Naphthalene	91-20-3	1-3
8) C10-C11 Alkylbenzenes	70693-06-0	1-10
9) Biphenyl (Diphenyl)	92-52-4	0.5-1.5
10) C12-C23 Aromatic Hydrocarbons	Mixture	5-15
11) C13-C25 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	10-20

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this product can cause minimal to mild eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials suggest that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. This hydrodesulfurized mixture is a middle distillate similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced. Based upon animal testing, the C9 aromatic hydrocarbon components (trimethylbenzenes and ethylmethylbenzenes) are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period. Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results.

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Olefins Plant Feed - 700°EP (OP-700)

Biphenyl (Diphenyl) may cause liver and/or nerve damage (See Section 11)

Conditions Aggravated by Exposure	Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases, and women attempting to conceive should avoid exposure
Target Organs	This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the blood, liver, kidneys, and reproductive system
Carcinogenic Potential	This material contains middle distillates at or above a 0.1% concentration and it is considered to be carcinogenic by IARC and OSHA. (See Section 11)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification			
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>
						Pyrophoric	<input type="checkbox"/>
						Water-reactive	<input type="checkbox"/>
						Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

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Olefins Plant Feed - 700°EP (OP-700)

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-II Combustible Liquid Highly combustible ¹		
Flash Point Method	CLOSED CUP 51° to 60°C (125° to 140°F) (Pensky-Martens (ASTM D-93))		
Lower Flammable Limit	AP 0.6 %	Upper Flammable Limit	AP 7.5 %
Autoignition Temperature	AP 257°C (494°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	<p>Combustible Liquid¹ This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.</p>		
Extinguishing Media	<p>SMALL FIRE Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>		
Protection of Fire Fighters	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.</p>		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid¹ Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

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Olefins Plant Feed - 700°EP (OP-700)

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N F P A's National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

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Olefins Plant Feed - 700°EP (OP-700)

Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)	TWA: 100 (mg/m ³) from ACGIH (TLV) - SKIN [Proposed]
2) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV)
	TWA: 200 (ppm) from OSHA (PEL) [Proposed]
3) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV)
	TWA: 25 (ppm) from OSHA (PEL) [Proposed]
4) Naphthalene	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN
	TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed]
	TWA: 10 (ppm) from OSHA (PEL)
5) Biphenyl (Diphenyl)	TWA: 0.2 (ppm) from ACGIH (TLV)
	TWA: 0.2 (ppm) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Transparent to slightly opaque, slightly pale to yellow	Odor	Characteristic, kerosene-like
Specific Gravity	0.84 to 0.88 at 60°F (Water = 1)	pH	Not applicable	Vapor Density	5.0 to 5.2 (Air = 1 at 70°F)
Boiling Point/Range	155° to 371°C (310° to 700°F) (ASTM D-2887)			Melting/Freezing Point	< -25°C (-13° F) (ASTM D-2396)
Vapor Pressure	1.6 to 1.8 mm Hg at 20°C (68°F) or LT 0.1 psi(a) at 100°F (38°C)			Viscosity (cSt @ 40°C)	2.5 to 4 (ASTM D-445) and < 8 cSt at -20°C
Solubility in Water	Negligible to slightly soluble in cold water (0.005 to 0.04%)			Volatile Characteristics	Volatile Organic Compounds (VOCs) Content = 100%, AP 825 gm/L
Additional Properties	Alkane, isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 66 to 91 Wt % (ASTM D-1319), C9-C24 Aromatic Hydrocarbon Content = 9 to 34 Wt % (ASTM D-1319), Average Density at 60°F = 7.203 lbs./gal. (ASTM D-2161), Cetane Number = > 40 (ASTM D-613) or Cetane Index = GT 42 (ASTM D-876), Saybolt Viscosity = 32 to 37 SUS at 100°F (ASTM D-2161), Sulfur Content = < 0.2 Wt % (by ASTM D-2622) or LT 0.5 Wt % (by ASTM D-129), Ash Content = < 0.01 Wt % (ASTM D-482), Ramsbottom Carbon Residue = LT 0.35 Wt % (ASTM D-524), Evaporation Rate = LT 0.04 when n-Butyl acetate = 1.0				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	No substances are readily identified from composition, and, no degradation data is available		

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Olefins Plant Feed - 700°EP (OP-700)

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrosulfurized Middle Distillate (Petroleum):

GAS (LC50) Acute 4.60 to 7.64 mg/L for 4 hours [Rat] - Dyspnea, nasal discharge, alopecia, and excess salivation

ORAL (LD50) Acute >500,000 mg/kg [Rat screen] - Diarrhea, hyperactivity, ptosis, urine-stained stomach, and somnolence

DERMAL (LD50) Acute >2,000 mg/kg [Rabbit screen]

BUEHLER DERMAL Acute Non-sensitizing [Guinea Pig]

INTRAVENOUS (LD50) Acute 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma.

14-Day DERMAL Subchronic 0.05 ml/kg applied 3 times per week [Mouse, Human skin grafted to Athymic nude Mice] - Irritation and epidermal hyperplasia

62-Week DERMAL Chronic 0.05 ml/kg applied 3 times per week [Mouse] - Extreme skin irritation, moderate increase in contact-point skin tumors

n-Nonane:

GAS (LC50) Acute: 3,200 ppm for 4 hours [Rat]

INTRAVENOUS (LD50) Acute: 218 mg/kg [Mouse]

Trimethylbenzenes:

ORAL (LD50) Acute: 8,970 mg/kg [Rat]

Ethylmethylbenzenes (Ethyltoluenes):

GAS (LC50) Acute: 50,000 mg/m³ for 2 hours [Cat]

GAS (LC50) Acute: 54,000 mg/m³ for 4 hours [Mouse]

Naphthalene:

ORAL (LD50) Acute: 490 mg/kg [Rat]

ORAL (LD50) Acute: 533 mg/kg [Mouse]

ORAL (LD50) Acute: 1,200 mg/kg [Guinea Pig]

SUBCUTANEOUS (LD50) Acute: 969 mg/kg [Mouse]

INTRAVENOUS (LD50) Acute: 100 mg/kg [Mouse]

INTRAPERITONEAL (LD50) Acute: 150 mg/kg [Mouse]

Biphenyl (Diphenyl or 1,1'-Biphenyl):

GAS (TCLo) Acute: 4,400 ug/m³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting

ORAL (LD50) Acute: >2,800 mg/kg [Cat screen]

ORAL (LD50) Acute: 2,400 mg/kg [Rat and Rabbit]

ORAL (LD50) Acute: 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea

DERMAL (LD50) Acute: >5,010 mg/kg [Rabbit screen]

INTRAVENOUS (LD50) Acute: 56 mg/kg [Mouse]

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 700°F., commonly referred to as "middle distillates, including both hydrosulfurized middle distillate and hydrosulfurized light catalytic cracked distillate" have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Hydrosulfurized middle distillate produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) assay, the in-vivo mouse SCE assay, the in-vitro mouse lymphoma assay without S9 activation, and the in-vivo rat bone marrow cell chromosome aberrations assay, however, the in-vitro mouse lymphoma assay with S9 activation produced a positive response. The significance of these animal study results to human health is unclear.

Studies with mice and rats have shown that some petroleum middle distillate fuels similar to this material have caused liver tumors and kidney damage and/or tumors. However, the kidney effects were sex hormone dependent and not seen in similar studies involving Guinea pigs, dogs, or monkeys. Also, the significance of the liver tumors in rodents is highly speculative relative to humans.

Studies with mice and rats have also shown that chronic exposures (8 hours/day, 7 days/week, for 24 months) to unfiltered diesel fuel exhaust produced lung tumors and lymphomas. On the basis of these studies, NIOSH recommended that complete diesel exhaust be regarded as a "potential carcinogen".

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Olefins Plant Feed - 700°EP (OP-700)

Numerous epidemiology studies have been carried out to test the hypothesis that lung and/or bladder cancers are associated with chronic exposure to diesel engine exhaust. The most comprehensive case-control and retrospective cohort studies on U.S. railroad workers showed an increased risk for lung cancer and this risk significantly increased with extended duration exposures. There are some indications that an elevated frequency of bladder cancer amongst bus and truck drivers may be due to diesel engine exhaust exposure.

Rats inhaling n-nonane at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Ethylmethylbenzenes are primary skin irritants and overexposures might cause liver and/or kidney damage or increase blood cholinesterase levels. Inhalation of these and other C9 aromatic hydrocarbons by pregnant mice and rats during gestational days 6 through 15 resulted in decreased fetal and newborn weights.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction or red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in 8 of 21 workers exposed to elevated levels of naphthalene vapors for 5 years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Also, naphthalene may cause fetal toxicity or damage. Laboratory studies produced limited evidence of fetal toxicity in pregnant female mice including decreased spleen weights.

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage. Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this material, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, volatile aromatic hydrocarbon components (trimethylbenzenes, ethylmethylbenzenes, naphthalene, and biphenyl) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalus cephalus*), similar middle distillates and some of this material's components showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 20 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Based upon actual spill incident investigations, similar mixtures have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This material is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

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Olefins Plant Feed - 700°EP (OP-700)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Petroleum distillates, n.o.s. (Nonanes, Ethylmethylbenzenes and/or Naphthalene); or Combustible liquid, n.o.s. (Petroleum distillates) or (Nonanes, Ethylmethylbenzenes, Naphthalene) in bulk.		
	This material has a flash point temperature of between 100° and 141°F (38° to 60°C). For bulk shipments, it is classified as a DOT "Flammable Liquid". However, according to 49 CFR 173.120(b)(2) and 173.150(f)(1), this material may be reclassified as a "Combustible Liquid" and exempted from certain transportation-related requirements, such as labeling, when shipped in non-bulk "limited-quantity" containers of less than 119 gallons capacity. According to 49 CFR 173.150(f)(2) and (3), this provision does not apply to "limited-quantities" offered for or transported via vessel or aircraft or products which are defined as DOT "Marine Pollutants". It is recommended that "Flammable Liquid" products which are reclassified be so identified on the bill-of-lading as "Combustible liquid, n.o.s. (Petroleum distillates) or (Nonanes, Ethylmethylbenzenes)" with identification number "NA1993".		
Hazard Class	DOT Class 3 (Flammable liquid)	Packing Group(s) UN/NA ID	PG III UN1268 or NA1993
Reportable Quantity	The Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are Naphthalene and Cumene.		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 122 17
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

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Olefins Plant Feed - 700°EP (OP-700)

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Naphthalene [CAS No. 91-20-3] concentration: 1 to 3% Biphenyl (Diphenyl) [CAS No. 92-52-4] concentration: 0.5 to 1.5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2270 kg]) concentration: 0 to 0.5% Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 3%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which is known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13). This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of 1,3,5-Trimethylbenzene (Mesitylene) [CAS No. 108-67-8] , this material might be subject to US EPA's one-time only per country export notification requirements. In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": Cumene [CAS No. 98-82-8] and Biphenyl (Diphenyl) [CAS No. 92-62-4].

HoustonRefining

A Lyondell Company

Olefins Plant Feed - 700°EP (OP-700)

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HIMS and NFPA Hazard Ratings for this product.

REVISION INFORMATION Logo and Manufacturer name change.
 Version Number 3.1
 Revision Date 11/01/06

ABBREVIATIONS

AP	Approximately	EQ	Equal	>	Greater Than	<	Less Than	NA	Not Applicable	ND	No Data	NE	Not Established
ACGIH	American Conference of Governmental Industrial Hygienists							AIHA	American Industrial Hygiene Association				
IARC	International Agency for Research on Cancer							NTP	National Toxicology Program				
NIOSH	National Institute of Occupational Safety and Health							OSHA	Occupational Safety and Health Administration				
NPCA	National Paint and Coating Manufacturers Association							HMS	Hazardous Materials Information System				
NFPA	National Fire Protection Association							EPA	US Environmental Protection Agency				

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0031
HFR#240

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0031
Revision Date 3/2/2005

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Gas. (Compressed gas/liquid.)
Color Colorless to light yellow. **Odor** Odorless or possible slight hydrocarbon. Possible rotten egg smell.

DANGER!

Extremely flammable compressed gas/liquid; Vapor may cause flash fire or explosion.

FLAMMABLE GAS. MAY CAUSE FLASH FIRE.

Repeated or excessive exposure to certain components of this mixture have been associated with central nervous system effects.

Breathing high concentrations can cause irregular heartbeats which may be fatal.

Liquid or compressed gas contact may cause frostbite or freeze burns.

EXPLOSIVE.

Hazard Rankings

	HMIS	NFPA
Health Hazard	2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	68478-81-6	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable.		
Synonyms	Catalytic Reformer Recycle Gas, Catalytic Reformer Gases from C6-C8 Feedstock (Petroleum), Reformer Hydrogen, Plant Hydrogen Recycle, Naphtha unifier Stripper Gas, Magnaformer Absorber Tower Feed Gas, Magnaformer Reformate Separator Tower Overhead Steam, Hydrogen and C1-C6 alkane and Isoparaffin Hydrocarbons Mixture, 637 HDS Recycle Gas.		

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

SECTION 2. COMPOSITION (TYPICAL)

Component Name(s)	CAS Registry No.	Concentration (%)
Hydrogen	1333-74-0	75 - 90
Methane	74-82-8	5 - 15
Ethane	74-84-0	1 - 10
Propane	74-98-6	1 - 5
Pentanes, all isomers	Mixture	<2
Iso-Butane	75-28-5	0.5 - 3
n-Butane	106-97-8	0.5 - 2
Nitrogen	7727-37-9	0.5 - 1.5
n-Hexane	110-54-3	<1
Hexane, other isomers	Mixture	<1
Hydrogen sulfide	7783-06-4	<0.01

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation Breathing this gas keeps the body from getting enough oxygen. Symptoms include dizziness, confusion, headache, and nausea. Continued breathing of this gas may lead to unconsciousness and death from suffocation. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.

Eye Contact This gas is non-irritating; however, direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."

Skin Contact Direct contact with an pressurized/liquefied expanding gas may produce severe and possibly permanent skin damage from frostbite or freeze burns.

Ingestion Ingestion is not an applicable route of exposure for gases.

Chronic Health Effects Summary There is no evidence that long-term, low-level exposure to components of this gas mixture cause any chronic adverse health effects in animals or humans.

Conditions Aggravated by Exposure Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, or cardiovascular conditions should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of "simple asphyxiants".

Exposure to high concentrations of **propane**, a minor component of this material, may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs The substance is toxic to mucous membranes, skin, eyes, central nervous system (CNS), and possibly the heart.

Carcinogenic Potential This material does not contain any components at concentrations at or above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP.

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).									
OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. Irrigate the eyes with copious amounts of clean, low-pressure, room-temperature water. Do not use hot water! Do not use eye ointment unless directed to by a physician. Seek medical attention if excessive tearing, irritation, or pain persists.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.
Flash Point	-185°C (-301°F) (Estimated)
Lower Flammable Limit	AP 2.0%
Upper Flammable Limit	AP 75%
Autoignition Temperature	AP 400°C (752°F)
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes and unburned hydrocarbons.

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area upwind. Remove all potential ignition sources. Safety stop the source gas flow using non-sparking tools. Allow the substance to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Prevent this material's entry into waterways, sewers, basements, or confined areas. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7. HANDLING AND STORAGE

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

Handling

This gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed.

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling pressurized and/or liquefied gases. Safety glasses equipped with side shields or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
Respiratory Protection	Odor is not an adequate warning for potentially hazardous air concentrations! For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).
General Comments	For an explanation about some of the occupational exposure limits shown below, refer to the definition of " Simple Asphyxiant " presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents handbook. Releases of these gases may cause atmospheres, some oxygen-deficient (LT 21 Vol.% in air), which can have flammable/explosive potential. DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Hydrogen	Simple asphyxiant.
Methane	Simple asphyxiant.
Ethane	Simple asphyxiant.
Propane	ACGIH (United States). TWA: 2500 ppm 8 hour(s).
	OSHA (United States). TWA: 1000 ppm 8 hour(s).
	Simple asphyxiant.
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s).
	OSHA (United States). TWA: 1000 ppm 8 hour(s).
Iso-Butane	ACGIH (United States). TWA: 800 ppm 8 hour(s).
n-Butane	ACGIH (United States). TWA: 800 ppm 8 hour(s).
Nitrogen	Simple asphyxiant.
n-Hexane	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s).
	OSHA (United States). TWA: 500 ppm 8 hour(s).
Hexane, other isomers	ACGIH TLV (United States). TWA: 500 ppm 8 hour(s).
	STEL: 1000 ppm 15 minute(s).
Hydrogen sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s).
	STEL: 15 ppm 15 minute(s).
	OSHA (United States). CEIL: 20 ppm 8 hour(s).
	STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s).
	STEL: 1000 ppm 15 minute(s).

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas. (Compressed gas/liquid.)	Color	Colorless to light yellow.	Odor	Odorless or possible slight hydrocarbon. Possible rotten egg smell.
Specific Gravity	0.07 to 0.38 (Water = 1)	pH	Not applicable.	Vapor Density	0.07 to 1.04 (Air = 1)
Boiling Range	-253° to -41°C (-423° to -43°F) at 14.7 psia			Melting/Freezing Point	-260° to -169°C (-435° to -272°F) at 14.7 psia
Vapor Pressure	205 to 250 psia at 40°C (104°F)			Volatility	This material is normally a gas. If released in liquid form, it will completely evaporate very quickly.
Solubility in Water	Negligible in cold water (LT 0.01 Wt.%).			Viscosity (cSt @ 40°C)	Not applicable.
Flash Point	-185°C (-301°F) (Estimated)				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Butane, all isomers

Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Propane

Studies in laboratory animals indicate exposure to extremely high levels of propane (1 to 10 vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Pentanes, all isomers

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

SECTION 12. ECOLOGICAL INFORMATION

- Ecotoxicity** Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage.
- Environmental Fate** **Hydrogen and light alkane/alkene gases** are essentially insoluble in water (LT 0.1%); and therefore, this material will not cause harm to aquatic life. These pressurized gas mixtures will normally disperse rapidly in air if released.
- The atmospheric half-lives of **methane, ethane, and propane** under photochemical smog conditions are estimated to be between 5 to 8 hours. Photooxidation of **propane** in air (LT 8%) is not considered environmentally significant.
- For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

- TSCA Inventory** This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
- SARA 302/304 Emergency Planning and Notification** The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Sudden Release of Pressure Hazard, and Acute (Immediate) Health Hazard.
SARA 313 Toxic Chemical Notification and Release Reporting	This material does not contain any components in concentrations at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This material is not known to contain chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a release.
Clean Water Act (CWA)	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 3/2/2005
Print Date Printed on 3/2/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist:				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

Reformate Gas, Hydrogen-Rich (C1-C6 Hydrocarbons)

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Sour LPG With Methyl Mercaptan

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0032
Revision Date 06/01/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquefied Gas.		
Color	Colorless liquid, invisible gas and vapor, white frost at release point	Odor	Strong, foul smelling, distinctive rotten egg or cabbage odor is unreliable as a warning of possible danger

DANGER! Extremely flammable and poisonous liquefied gas; vapor may cause flash fire or explosion!
May form explosive peroxides on exposure to air!
High pressure and rapid diffusion hazard!
Contains Hydrogen Sulfide (H₂S)! Corrosive to some metals!
May be harmful or fatal if inhaled or ingested! High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation!
Mist or vapor may cause eye, skin, mucous membrane, and respiratory tract irritation and inflammation!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Liquid or compressed gas contact may cause frostbite or freeze burns!
Overexposures may cause target organ effects such as lung, heart, central and sympathetic nervous systems, blood, liver, and/or kidney damage!

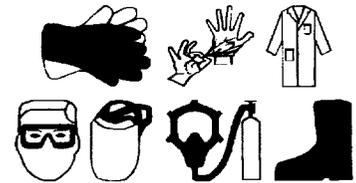
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Sour LPG With Methyl Mercaptan	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110032	Medical Emergency	(918) 495-4700
CAS Number	68514-31-8	CHEMTREC Emergency	(800) 424-9300
Product Family	Sour Gas		
Synonyms	Sour Liquefied Petroleum Gas or Sour LP-Gas, BRU No. 2 Depropanizer Tower Overhead Stream; Magnaformer (735) Stabilizer Tower Overhead Stream, C3-C4 Hydrocarbons Mixture Containing H ₂ S and CH ₃ -SH.		

**Sour LPG
With Methyl Mercaptan**

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Sour C3-C4 Hydrocarbons	68514-31-8	100
2) Liquefied Petroleum Gases	68476-85-7	100
3) Propane	000074-98-6	25-75
4) Iso-Butane	75-28-5	20-40
5) Butenes or Butylenes	25167-67-3	1-15
6) n-Butane	106-97-8	1-15
7) Propylene	115-07-1	1-15
8) Hydrogen sulfide	7783-06-4	1-10
9) Methyl mercaptan	74-93-1	0.1-1
10) Ethane	74-84-0	0-2
11) Iso-Pentane	78-78-4	0-2

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact. Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)</p> <p>Additionally, several components of this liquefied gas are "simple asphyxiants" High concentrations of this gas can displace the amount of oxygen available to breathe below that level necessary to sustain life. Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, weakness, nausea, vomiting, loss of coordination, unconsciousness, and coma, depending upon the concentration level and duration of exposure</p>
Eye Contact	<p>Vapors may cause moderate to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and methyl mercaptan and duration of exposure. Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."</p>
Skin Contact	<p>Direct contact with an expanding liquefied gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Hydrogen sulfide and methyl mercaptan can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases</p>
Ingestion	<p>Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus.</p>
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11)</p> <p>Chronic inhalation to components of this gas (propane, propylene, and n-butane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.</p>
Conditions Aggravated by Exposure	<p>Personnel with eye, skin, cardiac, pulmonary, liver, kidney, or neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas. They should take additional precautions to minimize or avoid exposure.</p>
Target Organs	<p>These streams are toxic to the eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, blood, and possibly, the bladder and the endocrine and reproductive systems</p>

**Sour LPG
With Methyl Mercaptan**

Carcinogenic Potential These streams do not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point/Method	CLOSED CUP: AP -107° to -73°C (-160° to -100°F) (Estimated)		
Lower Flammable Limit	AP 1.6 %	Upper Flammable Limit	AP 45 %
Auto-Ignition Temp.	AP 260°C (500°F)		

**Sour LPG
With Methyl Mercaptan**

Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans.
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide, and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safely stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling **Danger! Poisonous and Flammable Gas!** Do NOT breathe vapor, it contains **hydrogen sulfide (H₂S), methyl mercaptan, and simple asphyxiants**. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

Sour LPG With Methyl Mercaptan

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). H_2S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H_2S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable liquefied gases. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, methyl mercaptan, and simple asphyxiants.

Sour LPG With Methyl Mercaptan

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL)
2) Methyl mercaptan	TWA: 5 (ppm) from ACGIH (TLV) [1997] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998] TWA: 0.5 CEIL: 10 (ppm) from OSHA [1989]
3) Ethane	Simple asphyxiant.
4) Propylene	Simple asphyxiant
5) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
6) Propane	TWA: 2500 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
7) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1998] TWA: 800 (ppm) from OSHA (PEL) [1989]
8) Pentanes	TWA: 600 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1976]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas.	Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; distinctive rotten egg or cabbage odor is unreliable as a warning of possible danger.
Specific Gravity	AP 0.55 to 0.60 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to acidic H ₂ SO ₄ .	Vapor Density	AP 1.5 to 1.9 (Air = 1)
Boiling Point/Range	AP -60° to 27°C (-75° to 82°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			AP -187° to -82°C (-305° to -117°F) at 14.7 psia
Vapor Pressure	50 to 190 psia at 100°F	Viscosity (cSt @ 40°C)			Not applicable
Solubility in Water	Moderately soluble in cold water.	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Hydrogen Sulfide and Mercaptans Content = 1.1 to 11 Vol.%; C2-C5 Alkane, Isoparaffin, and Alkene Hydrocarbons Content = 89 to 98.9 Wt.% (ASTM D-1319), Gross Heat of Combustion at 60°F = AP 21,000 Btu/lb or 2,500 Btu/cu.ft., Average Density at 60°F = LT 5.00 lbs /gal. (ASTM D-2161).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

**Sour LPG
With Methyl Mercaptan**

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the *Emergency Overview on Page 1* and the *Hazards Identification in Section 3* of this MSDS.

Toxicity Data

Hydrogen sulfide.

- GAS (TCLo): Acute: 10 ppm for 15 minutes (Human) - Eye irritation
- GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation
- GAS (LC100): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death.
- GAS (LCLo): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.

Methanethiol (Methyl mercaptan):

- GAS (LC50): Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration.
- GAS (LC50): Acute: 6,530 ug/m³ for 2 hours [Mouse].

Propylene.

- GAS (LC50): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse].
- GAS (TCLo): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.

Iso-Butane.

- GAS (TCLo): Acute: 1,040,000 mg/m³ for 2 hours [Mouse] - Excitement.
- GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress

Iso-Butene (Isobutylene or 2-Methylpropene):

- GAS (LC50) Acute: 415,000 mg/m³ for 2 hours [Mouse]
- GAS (LC50): Acute: 620,000 mg/m³ for 4 hours [Rat].

n-Butane

- GAS (LC50): Acute: 660,000 mg/m³ for 4 hours [Rat].
- GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse]

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Methyl mercaptan acts as respiratory poison by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, it can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. It is also an eye irritant and has been shown to produce positive responses in various mutagenic assays.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on liquefied petroleum gas, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). **Propylene** has also been found to be a cardiac sensitizer in dogs. An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias.

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice; however, it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term exposure.

Sour LPG With Methyl Mercaptan

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to combinations of isobutane, n-butane, and butenes (additive effect), than the degree of narcosis exhibited following exposure to each gas alone.

Inhalation of 500 ppm of **isopentane** has been reported NOT to produce any ill effects in humans. Rat 28-day feeding studies done on **isopentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **propane, propylene, butenes, hydrogen sulfide, and methyl mercaptan** components of these streams may contribute to generation of atmospheric smog. The atmospheric half-lives of **propane, propylene, and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours, and, experimental data shows that significant photooxidation of propylene occurs rapidly within 14 to 21 hours. The atmospheric half-lives of the **butenes** under photochemical smog conditions are estimated to be between 5 and 7 days. **Isopentane** has an estimated half-life of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of **propane, isobutane, and n-butane** in air (LT 8%) are not considered to be environmentally significant. **Hydrogen sulfide** residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.

Environmental Fate

Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%); however, **hydrogen sulfide and methyl mercaptan** are moderately soluble in water so this material and any contaminated soil or water may be hazardous to human, animal, and aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitability (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Sour LPG
With Methyl Mercaptan**

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s Inhalation Hazard Zone B (Hydrogen sulfide, Methyl mercaptan)		
Hazard Class	Class 2.3. Poisonous gas.	Packing Group(s)	Not applicable
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Hydrogen sulfide and Methyl mercaptan		
Placards			Emergency Response Guide No. 119
		HAZMAT STCC No.	49 203 78
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	These streams and/or their components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances which might be present in these streams and are subject to this statute are: Hydrogen sulfide [CAS No. 7783-06-4] and Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] .
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	These streams contain the following components in concentrations which are at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Propylene or Propene [CAS No. 115-07-1] concentration: 1 to 15% Hydrogen sulfide [CAS No. 7783-06-4] concentration: 1 to 10%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that are present in these streams which are subject to this statute are: Hydrogen sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 10% Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] (RQ = 100 lbs. [45.36 kg]) conc.: 0.1 to 1%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	These streams do not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, they are not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in these streams as "Volatile Organic Compounds (VOC)" that contribute significantly to air pollution which endangers public health and welfare": Propylene (Propene), 1-Butene, Isobutylene, and Isopentane.

**Sour LPG
With Methyl Mercaptan**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Chemical substances which may be present in these streams that are subject to this statute are Hydrogen sulfide, Methyl mercaptan (Methanethiol), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, n-Butane, and Isopentane (Butane, 2-methyl)

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3 0
Revision Date 06/01/1999
Print Date Printed on 02/07/2000

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Refinery Gas (C1-C6), Sour with Mercaptans

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0033
Revision Date 09/16/2002

Hazard Rankings		
	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquefied Gas/ Liquid Mixture.		
Color	Colorless liquid, invisible gas and vapor, white frost at release point.	Odor	Strong, foul smelling, rotten egg or skunk odor is unreliable as a warning of possible exposure

DANGER! Extremely flammable and poisonous gas/liquid;
vapor may cause flash fire or explosion.

High pressure and rapid diffusion hazard.

High vapor concentrations reduce oxygen available for breathing.

Contains Hydrogen Sulfide (H₂S) and Mercaptans.

May be harmful or fatal if inhaled or absorbed through the skin.

May cause central nervous system (CNS) depression
or suffocation.

Compressed gas/liquid contact may cause frostbite/freeze burns.

Mist or vapor may cause mild to severe eye, skin, mucous
membrane, and respiratory tract irritation and inflammation.

Aspiration into the lungs will cause pulmonary edema and
chemical pneumonia.

Overexposures may cause central nervous system (CNS)
depression and other target organ effects.

Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats).

Potential cancer hazard. May contain low levels of Benzene.

May cause leukemia and/or other blood disorders.

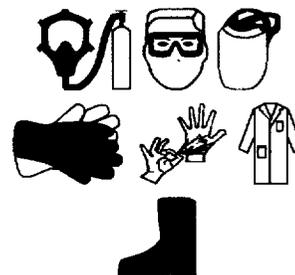
Mutagenic hazard; may cause genetic damage.

May adversely affect reproduction or reproductive development.

Spills may create a slipping hazard. Corrosive to some metals.

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Refinery Gas (C1-C6), Sour with Mercaptans	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110033	Medical Emergency	(918) 495-4700
CAS Number	Mixture (See Section 2.)	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Sour Hydrocarbon Gas Mixture		
Synonyms	Sour Refinery Gas, Mixture of Light Ends Fractionator (LEF) Gases; Gas Blend containing Hydrogen, Hydrogen Sulfide and Mercaptans, C1-C6 Hydrocarbons, H ₂ , H ₂ S, and R-SHs.		

Refinery Gas (C1-C6), Sour with Mercaptans

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrogen sulfide	7783-06-4	0.1-10
2) Methyl mercaptan	74-93-1	0.01-0.1
3) Ethyl mercaptan	75-08-1	0-0.01
4) Hydrogen	1333-74-0	5-40
5) Methane	74-82-8	40-80
6) Ethane	74-84-0	10-50
7) Propane	74-98-6	1-40
8) Butanes	Mixture	1-50
9) Pentanes	Mixture	1-40
10) Cyclopentane	287-92-3	1-10
11) Hexane Isomers	Mixture	1-20
12) Methylcyclopentane	96-37-7	0-3
13) n-Hexane	110-54-3	0-15
14) Cyclohexane	110-82-7	0-3
15) Benzene	71-43-2	0-1

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation Eye contact Skin contact Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 150 ppm or more of **methyl mercaptan** and 100 ppm or more of **hydrogen sulfide (H₂S)** are immediately dangerous to life and health (IDLH). For **ethyl mercaptan**, the NIOSH IDLH is 500 ppm. At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. And, at concentrations above 700 ppm, **methyl mercaptan** may cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11)

Additionally, at least one component of this gas/liquid mixture is a "simple asphyxiant". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.

Breathing high concentrations of the liquid-phase vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes.

Eye Contact

Vapors may cause mild to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentration of **hydrogen sulfide and mercaptans** and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn". Direct liquid contact can cause clouding of the cornea with small areas of superficial corneal necrosis.

Skin Contact

Direct contact with a liquefied/pressurized gas portion of this material may produce severe and possibly permanent skin damage from frostbite or freeze burns. Tests on this material's components suggest that moderate to severe skin irritation, inflammation, and blistering is expected to occur upon short-term liquid contact. Certain components of this material, including **hydrogen sulfide, methyl and ethyl mercaptans, n-hexane, cyclohexane, and benzene** may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases.

Refinery Gas (C1-C6), Sour with Mercaptans

Ingestion	<p>Ingestion of this material is highly unlikely due to its volatile nature. However, if swallowed this material may irritate the mucous membranes of the mouth, throat, and esophagus. The liquid-phase can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium. Additional central nervous system (CNS) effects may occur prior to the onset of convulsions, coma, and death.</p> <p>Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.</p>
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.</p> <p>Methyl and ethyl mercaptans, at low chronic exposures, may cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They have also been shown to produce positive responses in various mutagenic assays.</p> <p>Chronic inhalation to components of this material (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.</p> <p>Prolonged and/or repeated liquid or mist contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis. Also, chronic inhalation of this material's vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers.</p> <p>Even with acute exposures, n-hexane is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, 2,5-hexanedione, has been shown to cause degeneration of the testes.</p> <p>Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.</p> <p>Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. (See Section 11.)</p>
Conditions Aggravated by Exposure	<p>Personnel with eye, skin, cardiovascular, pulmonary, blood, liver, kidney, or neurological disorders, impaired hearing, high blood pressure, and chronic respiratory diseases or those with a compromised ability to use oxygen (asthmatics, anemics, etc.) should take additional precautions to minimize or avoid exposure.</p>
Target Organs	<p>These streams are toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, especially the auditory and peripheral nerves, brain, heart, liver, kidneys, thymus, and possibly, the endocrine and reproductive systems.</p>
Carcinogenic Potential	<p>This material contains benzene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP. (See Section 11.)</p>

Refinery Gas (C1-C6), Sour with Mercaptans

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910 1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible.

Skin Contact The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.

Ingestion Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician Nitrite as an antidote for acute **hydrogen sulfide** intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.

Inhalation overexposure can produce other toxic effects due to the **mercaptans**. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. If seizures occur, administer a benzodiazepine intravenously (Diazepam or Lorazepam) at 4 to 10 mg for an adult or 0.1 to 0.5 mg for a child. Consider use of phenobarbital if seizures recur (30 mg for an adult or a child over 5 years old). For methemoglobinemia symptoms, administer 1 to 2 mg/kg methylene blue slowly intravenously. Additional doses may be required.

This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Refinery Gas (C1-C6), Sour with Mercaptans

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas, Liquefied Gas, and IA Liquid		
Flash Point Method	CLOSED CUP. AP -107° to -73°C (-160° to -100°F) (Estimated)		
Lower Flammable Limit	1.6 to 4.0%	Upper Flammable Limit	AP 45%
Autoignition Temperature	260° to 288°C (500° to 550°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans.		
Special Properties	This gas/liquid mixture is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas/Liquid Mixture! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. Cover spill with a vapor-suppressing foam as soon as possible. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

Refinery Gas (C1-C6), Sour with Mercaptans

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off.

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it may contain **hydrogen sulfide (H₂S), mercaptans, and/or simple asphyxiants**. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Refinery Gas (C1-C6), Sour with Mercaptans

Eye Protection	Use chemical-type goggles and face shield (ANSI Z87 1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
Hand Protection	Avoid skin contact and use gloves (e.g. disposable neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this gas/liquid mixture may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Air purifying respirators offer no protection against hydrogen sulfide, mercaptans, and simple asphyxiants .

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 5 (ppm) from ACGIH (TLV) [Proposed]
2) Methyl mercaptan	TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) TWA: 0.5 (ppm) from ACGIH (TLV) TWA: 0.5 CEIL: 10 (ppm) from OSHA [Proposed] CEIL: 10 (ppm) from OSHA (PEL)
3) Ethyl mercaptan	TWA: 0.5 (ppm) from ACGIH (TLV) TWA: 0.5 CEIL: 10 (ppm) from OSHA (PEL) [Proposed]
4) Hydrogen	Simple asphyxiant
5) Methane	Simple asphyxiant
6) Ethane	Simple asphyxiant
7) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
8) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
9) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
10) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
11) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 (ppm) from OSHA (PEL) [Proposed]
12) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
13) n-Hexane	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 50 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
14) Cyclohexane	TWA: 100 (ppm) from ACGIH (TLV) TWA: 300 (ppm) from OSHA (PEL)
15) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) - SKIN

Refinery Gas (C1-C6), Sour with Mercaptans

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas/ Liquid Mixture.	Color	Colorless liquid; invisible gas and vapor, white frost at release point.	Odor	Strong, foul smelling; rotten egg or skunk odor is unreliable as a warning of possible exposure.
Specific Gravity	0.30 to 0.62 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to H ₂ SO ₄	Vapor Density	0.55 to 2.5 (Air = 1)
Boiling Point/Range	-253°C to 80°C (-423° to 176°F) [ASTM D-2887]			Melting/Freezing Point	-259° to -95°C (-435° to -140°F) at 14.7 psia.
Vapor Pressure	200 to 400 psia at 100°F			Viscosity (cSt @ 40°C)	Not applicable
Solubility in Water	Moderately soluble in cold water			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard Hydrogen Sulfide and Mercaptans Content = 0.11 to 10.11 Wt %; Alkane, Isoparaffin, Alkene, and Cycloalkane Hydrocarbons Content = 99 to 100 Wt % [ASTM D-1319], C6 Aromatic Hydrocarbon Content = 0 to 1 Wt % [ASTM D-1319]; Average Density at 60°F = < 5.00 lbs /gallon [ASTM D-2161]				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, calcium hypochlorite, chlorates, permanganates, nitrates, hydrogen peroxide, mercury oxide, and oxygen. Mercaptans and oxidizer mixtures and alkane hydrocarbons and chlorine gas mixtures have produced explosions. Under some conditions, mercaptans may react with water or steam to produce additional toxic and flammable vapors. Methyl and ethyl mercaptans and n-heptane may attack some forms of plastics, coatings, and rubber.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Methanethiol (Methyl mercaptan):
	GAS (LC ₁₀): Acute 4 ppm for 15 minutes [Human] - Nausea and headache.
	GAS (LC ₅₀): Acute 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration
	GAS (LC ₅₀): Acute 6,530 ug/m ³ for 2 hours [Mouse]
	Ethanethiol (Ethyl mercaptan):
	GAS (LC ₅₀): Acute 2,770 ppm for 4 hours [Mouse] - Excitement, motor activity changes, and cyanosis.
	GAS (LC ₅₀): Acute 4,420 ppm for 4 hours [Rat] - Excitement, spastic paraparesis, and cyanosis.
	ORAL (LD ₅₀): Acute 682 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.
	INTRAPERITONEAL (LD ₅₀): Acute 226 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis
	Hydrogen sulfide:
	GAS (TC ₁₀): Acute: 10 ppm for 15 minutes (Human) - Eye irritation
	GAS (TC ₁₀): Acute 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation.
	GAS (LC ₁₀₀): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death.
	GAS (LC ₁₀): Acute 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death

Refinery Gas (C1-C6), Sour with Mercaptans

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (> 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Methyl and ethyl mercaptans act as respiratory poisons by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, they can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They are also eye irritants and have been shown to produce positive responses in various mutagenic assays.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol % in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred, however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects, however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic. **n-Hexane** is NOT a tumor promoter in mice and NOT considered to be carcinogenic, nor is it teratogenic in mice or rats. **n-Hexane**, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats, but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depression, narcosis, and death at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral routes, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys and brain. Cyclohexane does not act as a promoter for tumors on mice when exposed to dimethylbenzanthracene. Further, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation, however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Refinery Gas (C1-C6), Sour with Mercaptans

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Prolonged and repeated exposure to high concentrations of benzene is associated with injury to blood forming organs and anemia. Consumption of alcohol may increase the blood system changes related to benzene exposure. It is linked to the development of acute myelogenous leukemia (AML) in humans. NTP, IARC, and OSHA list benzene as carcinogenic to humans. Studies of workers exposed to high levels of benzene have identified humoral and cellular immunity impairment and a decrease in levels of circulating leukocytes. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice. Animal studies have shown testicular effects and alterations in reproductive cycles with some evidence of developmental effects. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **hydrogen sulfide and the mercaptan** components of this material may contribute to generation of atmospheric smog. If released, the **volatile aromatic hydrocarbon component (benzene)** may also contribute to the creation of atmospheric smog. The atmospheric half-life of **propane** under photochemical smog conditions are estimated to be between 5 to 8 hours. The atmospheric half-lives of **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **propane, isobutane, and n-butane** in air (< 8%) are not considered environmentally significant.

Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time. The **pentanes, n-hexane, and hexane isomers** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Both **cyclopentane and cyclohexane** have a half-lives of from 6 hours to over 4 days when hydroxyl radicals are present.

Ecological effects testing has not been conducted on these streams. If spilled, the naphtha portion of these streams, their storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels. Also, toxic **hydrogen sulfide and the mercaptans** are moderately soluble in water.

Environmental Fate

The naphtha portion of this mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHMTADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Refinery Gas (C1-C6), Sour with Mercaptans

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas/liquid to the atmosphere should be avoided. Maximize material recovery for reuse or recycling.

If spilled and the naphtha portion of this mixture is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase and vapor emissions from the process might prove to be a potential health hazard. The naphtha portion of this mixture is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Compressed gases, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Methane)		
Hazard Class	DOT Class: 2.3 (Poisonous gas) and 2.1 (Flammable gas).	Packing Group(s) UN/NA ID	Not applicable. UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Hydrogen sulfide and Methanethiol (Methyl mercaptan) and/or Benzene		
Placards			Emergency Response Guide No. 119 HAZMAT STCC No. 49 203 78 MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances which are present in this material and subject to this statute are: Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.1 to 10% Methanethiol (Methyl mercaptan) [CAS No. = 74-93-1] concentration: 0.01 to 0.1%.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactive, & Acute (Immediate) & Chronic (Delayed) Health Hazards.

Refinery Gas (C1-C6), Sour with Mercaptans**SARA 313**

This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313

Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.1 to 10%
Methanethiol (Methyl mercaptan) [CAS No. = 74-93-1] concentration: 0.01 to 0.1%
n-Hexane [CAS No. 110-54-3] concentration: 0 to 15%
Cyclohexane [CAS No. 110-82-7] concentration: 0 to 3%
Benzene [CAS No. 71-43-2] concentration: 0 to 1%.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which might be present in this material that are subject to this statute are

Hydrogen sulfide [CAS No. = 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 10%
Methanethiol (Methyl mercaptan) [CAS No. = 74-93-1] (RQ = 100 lbs. [45.36 kg]) conc.: 0.01 to 0.1%
n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 0 to 15%
Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 3%
Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0 to 1%.

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802

California Proposition 65

These streams contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5 **Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].**

New Jersey Right-to-Know Label

For New Jersey labeling, refer to the components listed in Section 2.

Additional Regulatory Remarks

Under Section 12(b) of the Toxic Substances Control Act. Because it might contain detectable amounts of **Cyclohexane (CAS No. 110-82-7)**, this material might be subject to US EPA's one-time only per country export notification requirements.

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": **Isopentane [CAS No. 78-78-4], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], and possibly Benzene [CAS No. 106-98-9].**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in this material which are subject to this statute include: **Hydrogen sulfide, Methyl mercaptan (Methanethiol), Ethyl mercaptan (Ethanethiol), Hydrogen, Methane, Ethane, Propane, Isobutane (Propane, 2-methyl), n-Butane, Isopentane (Butane, 2-methyl), 2,2-Dimethylpropane (Neopentane), and n-Pentane.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 4.0
Revision Date 09/16/2002
Print Date Printed on 09/16/2002.

ABBREVIATIONS

AP: Approximately	EQ Equal	> Greater Than	< Less Than	NA: Not Applicable	ND No Data	NE: Not Established
ACGIH American Conference of Governmental Industrial Hygienists				AIHA American Industrial Hygiene Association		
IARC International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH National Institute of Occupational Safety and Health				OSHA Occupational Safety and Health Administration		
NPCA National Paint and Coating Manufacturers Association				HMIS. Hazardous Materials Information System		

Refinery Gas (C1-C6), Sour with Mercaptans

NFPA: National Fire Protection Association

EPA US Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

Material Safety Data Sheet

MSDS No
RS0038

Sulfur Plant Gas

HMIS	IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product. This product is covered by the OSHA Hazard Communication Standard and this document has been prepared in accord with the MSDS requirements of the rule.	Protective Equipment
Health Hazard *4		
Fire Hazard 4		
Reactivity 0		
* = Chronic Health Hazard		

SECTION 1: IDENTIFICATION

Trade Name	Sulfur Plant Gas	MSDS No.	RS0038
Product Number	1111111147	Revision Date	3/18/98
CAS Number	Mixture See section2		
Synonyms	Acid gas, sulfur plant incinerator gas, sulfur plant flare gas		
Generic Name	Sour refinery gases		
Chemical Family	Mixed inorganic gases and steam		
Manufacturer	LYONDELL-CITGO Refining Company Ltd. 12000 Lawndale Avenue P O Box 2451 Houston, Texas 77252-2451	Telephone Numbers	800/424-9300 CHEMTREC 800/313-7645 Company Hot Line 713/321-4215 MSDS Requests

SECTION 2: COMPOSITION

Component Name	CAS Number	Carcinogenic Listings	Concentration Wt%
NITROGEN	7727-37-9	Not applicable	AP 50 to 65
WATER	7732-18-5	Not applicable	AP 30 to 45
HYDROGEN	1333-74-0	Not applicable	AP 5 to 20
HYDROGEN SULFIDE	7783-06-4	Not applicable	AP 0.1 to 3
SULFUR DIOXIDE	7446-09-5	Not applicable	AP 0.01 to 3
CARBON DIOXIDE	124-38-9	Not applicable	AP 1

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Signal Word	DANGER!	Color	Colorless
Physical State	Gas	Odor	Offensive rotten egg and/or irritating, suffocating odor
Physical and Health Hazards	Extremely flammable poisonous gas! Harmful or fatal if inhaled. May cause flash fire or explosion. Corrosive irritant to eye, skin and mucous membranes. Irritating to the respiratory tract and may cause respiratory paralysis. Contact with liquefied or compressed gas may cause frostbite or freeze burns. Sudden release of pressure may turn compressed gas cylinder into a projectile. Corrosive to some metals. Possible reproductive/developmental hazard.		
Environmental Hazards	Ecological effects testing has not been conducted on this material Spilled material and any soil or water which it has contacted may be hazardous to plants, animals, and/or aquatic life Releases are expected to cause only localized non-persistent environmental damage		

POTENTIAL HEALTH EFFECTS

Routes of Exposure Inhalation, eye and skin contact, and skin absorption

Signs and Symptoms of Acute Exposure

• Inhalation	<p>Poison, may be fatal if inhaled! A 20 ppm concentration of sulfur dioxide is objectionably irritating. High concentrations may cause severe airway obstruction, pulmonary edema (an accumulation of fluid in the lungs) and death. 500 ppm of sulfur dioxide is so objectionable that a person cannot inhale a single deep breath. The effects of pulmonary edema include coughing and shortness of breath which can be delayed until hours or days after the exposure. These symptoms are aggravated by physical exertion. As a result of severe exposures, permanent lung damage may occur.</p> <p>Concentrations of hydrogen sulfide at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. Exposure to H₂S concentrations between 250 ppm and 500 ppm may result in headache, nausea, irregular heartbeat, and coma. Concentrations of hydrogen sulfide greater than 500 ppm may cause sudden collapse, respiratory paralysis, convulsions and death.</p> <p>Breathing concentrations of CO₂ greater than 2% can effect respiratory function and cause excitation followed by central nervous system depression. Symptoms include increased pulse rate, headache, dizziness, restlessness, disorientation and visual distortion. Exposure may affect the heart and eyes.</p>
• Eye Contact	Corrosive, high concentrations of sulfur dioxide may cause corneal burns. Extremely irritating. May cause sensitivity to light. Direct contact with liquefied/pressurized gas may produce severe and possibly permanent damage from freeze burns (frostbite).
• Skin Contact	Sulfur dioxide will react with moisture on the skin and cause corrosive irritation. Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent damage from freeze burns.
• Ingestion	Ingestion is not an applicable route of exposure for gases.
Chronic Health Effects Summary	<p>Repeated exposure to low levels of SO₂ (below 5 ppm) can cause permanent pulmonary impairment. Possible effects of chronic exposure to low levels of hydrogen sulfide are eye irritation, bronchitis, irregular heartbeat, and nerve damage.</p> <p>Chronic exposure to carbon dioxide may cause an acid-base imbalance in the blood, impaired attentiveness, a fall in blood pressure, and an impaired response of the circulatory system to exercise.</p>
Conditions Aggravated by Exposure	Personnel with eye, skin, respiratory, neurological, or cardiovascular disorders should take additional precautions to minimize or avoid exposure.
Target Organs	Eyes, skin, mucous membranes, respiratory system, central nervous system, and heart.
Carcinogenic Potential	Please refer to Sections 2 and/or 11 for the identification of components, if any, which have been identified as having carcinogenic potential in animals and/or humans.

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS.

Inhalation	Move the exposed person to fresh air at once. If breathing has stopped, initiate artificial respiration, if the heart has stopped, administer cardiopulmonary resuscitation (CPR). When breathing is difficult, properly trained personnel may administer 100% oxygen. Keep the affected person warm and at rest. Get medical attention as soon as possible.
Eye Contact	Check for and remove contact lenses. If eye tissue is frozen, seek medical attention immediately. If tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation, pain, swelling, tearing or light sensitivity persists, obtain medical attention as soon as possible.
Skin Contact	If frostbite has occurred, seek medical attention immediately. Do not rub the affected areas or flush them with water. In order to prevent further damage, do not attempt to remove frozen clothing from frostbitten areas. If frostbite has not occurred, immediately and thoroughly flush contaminated skin with lukewarm, gently running water for at least 5 minutes. If irritation persists, obtain medical attention.
Ingestion	Ingestion is not a route of exposure.
Notes to Physician	Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal.

SECTION 5: FIRE FIGHTING MEASURES**FLAMMABLE PROPERTIES**

Flammability Classification	Extremely flammable gas ¹
Flash Point/Method	AP -305°F (-187°C)/estimated, based on hydrogen
Flammable Limits %	LEL: AP 4 UEL: AP 75 based on NFPA "hydrogen"
Auto-Ignition Temperature	AP 500 °F (260°C)/bases on NFPA "hydrogen sulfide".
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, or other harmful, toxic gases including oxides and/or other compounds of sulfur
Special Properties	Extremely flammable gas, exposed to an ignition source it will burn in the open or explode in a confined space Being heavier than air, its flammable vapors may travel long distances along the ground before reaching a source of ignition and flashing back Vapors may collect in low or confined areas Containers may explode when heated

EXTINGUISHING MEDIA

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED!
Cool tanks and containers with water fog or spray in order to prevent pressure build-up, autoignition or explosion Use water, dry chemical, carbon dioxide, or inert gas to extinguish adjacent burning materials

FIRE FIGHTING

Protective Equipment/Clothing Wear a NIOSH-approved positive pressure self-contained breathing apparatus and full-protective equipment No skin area should be exposed

Instructions: STOP GAS FLOW! Evacuate area and fight from a maximum distance or use unmanned hose holders or monitor nozzles Use water spray to reduce vapors or divert vapor cloud drift Containers can build up pressure if exposed to heat, cool with flooding quantities of water until well after the fire is out Do not direct water at source of leak or pressure relief devices, icing may occur Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel ALWAYS stay away from the ends of "bullet" tanks

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS

Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire Do not touch or walk through spilled material Stop leak if it can be done without risk If possible, turn leaking containers so that gas escapes rather than liquid Prevent entry into waterways, sewers, basements or confined areas Do not direct water at spill or source of leak Use water spray to reduce vapors or divert vapor cloud drift Isolate area until gas has dispersed

Use water spray curtain to divert vapor drift Prevent entry into sewers, basements or confined areas Warn personnel to move away Stop leak if without risk

SECTION 7: HANDLING and STORAGE**Handling**

Keep away from heat, sparks, flame and other sources of ignition Use only in a closed system constructed from resistant materials Keep containers tightly closed Use spark-proof tools and explosion proof equipment Do not enter storage area unless adequately ventilated

Do not breathe this gas, hydrogen sulfide's rotten egg-like odor is not reliable as a warning of possible exposure¹ A continuous monitoring system with alarms is recommended for work area where hydrogen sulfide is routinely present Emergency self-contained breathing apparatus should be readily available Avoid contact with eyes, skin, and clothing Emergency eye wash stations should be available nearby Wash thoroughly after handling

Hydrogen sulfide and sulfur dioxide can be very corrosive in the presence of moisture

Storage

Flammable gas should be stored in a separate safety storage cabinet or room. Keep away from heat, sparks, and all other ignition sources, segregate from incompatible materials. Keep containers tightly closed, plainly labeled, out of closed vehicles, and in a cool, well-ventilated place. A well-ventilated, refrigerated room is preferable for materials with flash points lower than 70°F (AP 21°C). Containers should be able to withstand pressures expected from warming or cooling in storage. Do not puncture or incinerate containers. Do NOT contact with oxidizable materials.

Cylinders must be stored upright and firmly secured, avoid placing them in high-traffic areas. Valve caps should remain on all cylinders not in use. Ground all containers and transfer vessels. Storage and handling facilities should meet the applicable requirements of the National Electrical Code and National Fire Protection Association standards.

SECTION 8: EXPOSURE CONTROLS and PERSONAL PROTECTION**ENGINEERING CONTROLS**

Engineering controls are normally required when handling this material. Use closed systems or other other controls to maintain airborne levels below recommended exposure limits. For ventilation systems, use a corrosion-resistant ventilation system separate from other exhaust ventilation systems. Treatment of exhaust gases to prevent environmental contamination may be required. Supply sufficient replacement air to make up for air removed by exhaust systems. Emergency safety showers and eye wash stations should be readily accessible.

PERSONAL PROTECTIVE EQUIPMENT• *Protective Equipment*• *Eye Protection*

Use a respirator with a full facepiece

• *Skin Protection*- *Hands*

Avoid skin contact. Use chemically resistant gloves suited for acids.

- *Body*

Avoid skin contact, wear chemical resistant protective clothing. This might include apron, slicker suit, boots, and additional facial protection.

• *Respiratory Protection*

A full-face supplied air respirator with escape bottle or a positive-pressure pressure-demand self-contained breathing apparatus (SCBA) is required.

• *General Comments*

IDLH for SO₂ = 100 ppm, IDLH for H₂S = 100 ppm

EXPOSURE GUIDELINES

Substance	Source	Date	Type	Value	Time
HYDROGEN	ACGIH	1997		"Simple	NA
NITROGEN	ACGIH	1997		Asphyxiant"	NA
HYDROGEN SULFIDE	OSHA	1989	PEL	10 ppm	8 hours
HYDROGEN SULFIDE	OSHA	1989	STEL	15 ppm	15 minutes
HYDROGEN SULFIDE	ACGIH	1997	TLV	10 ppm	8 hours
HYDROGEN SULFIDE	ACGIH	1997	STEL	15 ppm	15 minutes
SULFUR DIOXIDE	OSHA	1989	PEL	2 ppm	8 hours
SULFUR DIOXIDE	OSHA	1989	STEL	5 ppm	15 minutes
SULFUR DIOXIDE	ACGIH	1997	TLV	2 ppm	8 hours
SULFUR DIOXIDE	ACGIH	1997	STEL	5 ppm	15 minutes
CARBON DIOXIDE	OSHA	1989	PEL	10,000 ppm	8 hours
CARBON DIOXIDE	OSHA	1989	STEL	30,000 ppm	15 minutes
CARBON DIOXIDE	ACGIH	1997	STEL	30,000 ppm	15 minutes
CARBON DIOXIDE	ACGIH	1997	TLV	5,000 ppm	8 hours

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas		
Color	Colorless		
Odor	Offensive rotten egg and/or irritating, suffocating odor		
pH	Acidic		
Vapor Pressure	AP 15 to 35 psia at 70 °F	Viscosity	Not applicable
Vapor Specific Gravity	AP 1.3 (air = 1)	Melting/Freezing Pt.	AP -346 to -121°F (-210 to -85°C)
Volatile Characteristics	Appreciable	Solubility in Water	Appreciable
Boiling Point/Range	AP -321 to -76°F (-196 to -60°C)	Specific Gravity	AP 0.45
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable		
Conditions to Avoid	Heat, flame, or strong oxidizing or reducing agents SO ₂ will react with water or steam to produce toxic and corrosive vapors		
Incompatibility with Other Materials	Strong oxidizing and/or reducing agents and metal catalysts Corrosive to steel		
Hazardous Decomposition Products	Burning or excessive heating may produce oxides of carbon and sulfur, smoke, and possibly other harmful gases		
Hazardous Polymerization	Will not occur		

SECTION 11: TOXICOLOGICAL INFORMATION**HYDROGEN SULFIDE (H₂S):**

TE _{Lo}	Acute	AP 1 ppm (Human) - Odor Response Threshold
TC _{Lo}	Acute	AP 10 ppm (Human) (15 minutes) - Eye irritation
TC _{Lo}	Acute	50 to 100 ppm (Human) (15 minutes) - Respiratory irritation
LC _{Lo}	Acute	600 ppm (Human) (30 minutes) - Unconsciousness, respiratory paralysis, and death
LC ₁₀₀	Acute	600 to 750 ppm (Human) (15 minutes) - Unconsciousness, respiratory paralysis, and death
LC _{Lo}	Acute	5,700 ug/kg (Human) - Chronic pulmonary edema, coma, and death
LC _{Lo}	Acute	800 ppm (Rat) (5 minutes)
LC ₅₀	Acute	635 ppm (Mouse) (1 hour)
LC ₅₀	Acute	445 ppm (Rat) (4 hours) - Hypermotility, diarrhea, and increased urine volume

Subchronic

5 weeks Rats 100 ppm for 8 hours/day - pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase

Teratogenesis 20 ppm for 24 hours on days 6 through 22 of pregnancy (rat) - developmental physical effects

SULFUR DIOXIDE

LC ₅₀ Rat	2520 ppm/1 hour
LC ₅₀ Mouse	3000 ppm/30 minutes

IARC Group 3 - Not Classifiable
ACGIH A4 - Not classifiable as a human carcinogen

EYE IRRITATION Temporary clouding of the eyes was seen in rabbits, guinea pigs and mice exposed for 4 hours to 400 ppm Very severe eye injury was produced in rabbits exposed to pure sulfur dioxide for 5 seconds

Experimental data has been reported showing reproductive and mutagenic effects

CARBON DIOXIDE (CO₂)

LC_{Lo} Acute 90,000 ppm (Human) (5 minutes)

LC_{Lo} Acute 90,000 ppm (Guinea Pig) (5 minutes)

30-Day GAS Subchronic 10,000 ppm for 24 hours/day (Rat) - Blood changes

30-Day GAS Subchronic 27,000 ppm for 24 hours/day (Rabbit)- Somnolence

42-Day GAS Subchronic 15,000 ppm for 24 hours/day (Human males) -
Headaches, deepened respiration, breathing difficulty upon exertion, metabolic acidosis, and increased
Calcium deposits in soft tissues

GAS TERATOGENESIS Sub-chronic 60,000 ppm for 24 hours on day 10 of
pregnancy (Rat) - Developmental abnormalities of the respiratory, cardiovascular, and musculoskeletal
systems and reduced newborn growth statistics

GAS TERATOGENESIS Sub-chronic 20,000 ppm for 8 hours on day 10 of
pregnancy (Mouse) - Developmental abnormalities of the musculoskeletal system and post-implantation
mortality

GAS TERATOGENESIS Sub-chronic 13,000 ppm for 4 hours on days 9 thru 12
of pregnancy (Rabbit females) - Developmental abnormalities of the musculoskeletal system

GAS TERATOGENESIS Sub-chronic 550,000 ppm for 2 hours on day 3 prior to mating (Mouse males) -
Spermatogenesis

GAS TERATOGENESIS Sub-chronic 550,000 ppm for 4 hours on day 6 prior to mating (Mouse males) -
Reduced male fertility index

Carbon Dioxide can affect male fertility and produce birth defects in laboratory animals Even though no
human reproductive data is available concerning Hydrogen Sulfide, Ammonia, or Carbon Dioxide, this gas
mixture can be expected to be a possible threat to the well-being of the unborn if a pregnant woman is
exposed to a high enough dose to render her unconscious

SECTION 12: ECOLOGICAL INFORMATION

Ecological effects testing has not been conducted on this product Releases have the potential to cause
significant adverse effects until dissipated

Hydrogen sulfide is toxic to both plants and animals and is harmful to aquatic life in very low concentrations If
it is spilled onto the soil, it will be rapidly released to the atmosphere However, it is soluble in water and the
presence of precipitation or ground water at the time of the spill will influence its environmental fate
Residence times in the atmosphere range from one day to more than 40 days, depending upon season, and
atmospheric conditions

Sulfur dioxide is oxidized in the environment to sulfuric acid which is a major component of acid rain Acid rain
has been associated with accelerated leaching of heavy metals from plumbing systems and generally fixed
sites such as insoluble deposits and ores, and with bioaccumulation of heavy metals especially mercury, in
fish Acidified water may cause transformation of mercury to a more toxic form (methylmercury) and can also
be corrosive to tissue

Sulfur dioxide is harmful to aquatic life in very low concentrations Notify local wildlife authorities of water spills
Sulfur dioxide inhibited higher plant photosystem II (PSII) activity via the action of sulfate on binding of chloride
and two extrinsic proteins

SECTION 13: DISPOSAL CONSIDERATIONS

Disposal should be conducted through a facility equipped with and operating an air emission control device in
accordance with the requirements of applicable Clean Air Act regulations

SECTION 14: TRANSPORT INFORMATION

DOT Status A U S Department of Transportation regulated material
Proper Shipping Name Compressed gas, toxic, flammable, corrosive, n o s (hydrogen sulfide, sulfur dioxide)
Inhalation Hazard Zone B
Hazard Class 2 3
UN/NA ID UN3304 **Packing Group(s)** Not applicable.
Reportable Quantity RQ (hydrogen sulfide, sulfur dioxide)



Emergency Response Guide Number 123
HAZMAT STCC Number 49 201 65
MARPOL III Status Not a "Marine Pollutant"

SECTION 15: REGULATORY INFORMATION

TSCA All components of this product are listed on the Toxic Substance Control Act (TSCA) inventory

SARA 302/304 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning and notification based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. **Chemical substances present in this product subject to this statute are: HYDROGEN SULFIDE and SULFUR DIOXIDE.**

SARA 311/312 The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2 **This material would be classified under the following hazard categories: Immediate (acute) and Delayed (chronic) Health Hazards, Fire Hazard, and Sudden Release of Pressure.**

SARA 313 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of an annual Toxic Chemical Release Inventory Report (Form R) by facilities which receive, import, make, process, or otherwise use "Toxic Chemicals" above specified threshold quantities. These facilities must also notify their customers if a product contains "Toxic Chemicals" regulated under 40 CFR 372.65. This information must also be included in all MSDS's that are copied and distributed for the product. **Chemical substances present in this product subject to this statute are: HYDROGEN SULFIDE.**

CERCLA The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of hazardous substances equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. **Chemical substances present in this product subject to this statute are:**
HYDROGEN SULFIDE RQ: 100 Pound(s) (45 Kg)
SULFUR DIOXIDE RQ: 500 Pound(s) (227 Kg)

California Proposition 65 The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) requires warning be given for ingredients known to the State of California to cause cancer, birth defects, or other reproductive toxicity. **This product contains no known chemical substances subject to this statute.**

Additional Regulatory Remarks The Clean Air Act Section 112(r) (40 CFR 68.130) requires development, implementation, and submission of risk management plans for facilities that manufacture, process, use, store or otherwise handle regulated substances in quantities that exceed listed thresholds. **Substances present in this product which are subject to this statute are: HYDROGEN and HYDROGEN SULFIDE.**

SECTION 16: OTHER INFORMATION**HMIS (U.S.A.)**

Health Hazard	*4
Fire Hazard	4
Reactivity	0

* = Chronic Health Hazard

**National Fire
Protection Association
(U.S.A.)**

**REVISION INFORMATION**

Version Number 04
Revision Date 3/18/98
Latest Revision Converted to ANSI 16-section format on 3/18/98
Print Date Printed on 4/13/98

ABBREVIATIONS

AP = Approximately EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data

ACGIH = American Conference of Governmental Industrial Hygienists

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Light Overhead Liquids

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0041
Revision Date 08/26/2002

Hazard Rankings		
	HMS	NFPA
Health Hazard	* 2	1
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquefied Gas
Color Colorless liquid; invisible
Odor Faint, unpleasant
gas and vapor, white
frost at release point.

DANGER! High pressure and rapid diffusion hazard!
Extremely flammable gas/liquid; vapor may cause flash fire
or explosion!

High vapor concentrations reduce oxygen available for breathing!
May cause central nervous system (CNS) depression
or suffocation!

Liquid or compressed gas contact may cause frostbite
or freeze burns!

Vapor or mist may irritate mucous membranes and
respiratory tract!

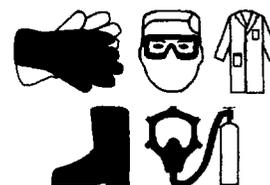
Liquid contact may cause mild to moderate eye and/or
skin irritation!

May be harmful or fatal if inhaled or absorbed through the skin!
Overexposures may cause target organ effects such as lung,
brain, liver, and/or kidney damage!

Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats)!

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Light Overhead Liquids	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068512914*	Medical Emergency	(918) 495-4700
CAS Number	68512-91-4 or 68476-85-7	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)		
Synonyms	C3-C5 Alkane and Alkene Hydrocarbons Mixture; C3-C5 Hydrocarbons.		

Light Overhead Liquids

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) C3-C5 Hydrocarbons	68783-64-2	100
2) Liquefied Petroleum Gases	68476-85-7	100
3) Propane	74-98-6	10-20
4) Propylene	115-07-1	1-5
5) Isobutane	75-28-5	25-35
6) Butenes or Butylenes	25167-67-3	1-10
7) n-Butane	106-97-8	30-50
8) Iso-Pentane	78-78-4	1-10
9) Pentenes or Pentylenes	68527-11-7	0.5-1.5
10) n-Pentane	109-66-0	1-5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact. Eye contact.

Signs and Symptoms of Acute Exposure

Inhalation	At least one component of this gas/liquid mixture is a "simple asphyxiant" (see Section 8) High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces Breathing vapors may also cause central nervous system (CNS) depression Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure
Eye Contact	Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Prolonged or repeated vapor exposure may cause irritation. This is based upon animal test results for this product's heavier components
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns The liquid form may cause mild to moderate skin irritation and inflammation
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus or be aspirated into the lungs. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Chronic inhalation to components of this liquefied gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs .
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.
Target Organs	This substance is toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, and possibly, the liver and/or kidneys.
Carcinogenic Potential	This material does not contain any components at concentrations at or above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP.

Light Overhead Liquids

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines and other sympathomimetic drugs such as epinephrine (adrenaline) should be reserved for emergency situations and then used only with special precaution.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point Method	CLOSED CUP: < -60°C (-76°F) [Estimated]		
Lower Flammable Limit	AP 1.5%	Upper Flammable Limit	AP 9.5%
Autoignition Temperature	AP 288°C (550°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, and unburned hydrocarbon vapors.		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Some components are lighter than air and rise rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, this material will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources!		

Light Overhead Liquids

- Extinguishing Media** DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
- Protection of Fire Fighters** Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a hissing sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safely stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling This liquefied gas mixture contains a "simple asphyxiant". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Light Overhead Liquids

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources. Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N F P A 's National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid, solid, or vapors.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

For an explanation about some of the occupational exposure limits shown below, refer to the definition of "Simple Asphyxiant" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents handbook. Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

Light Overhead Liquids

1) Propylene	Simple asphyxiant
2) Propane	TWA 2500 (ppm) from ACGIH (TLV) TWA 1000 (ppm) from OSHA (PEL) [Proposed]
3) Butanes	TWA 800 (ppm) from ACGIH (TLV) TWA 800 (ppm) from OSHA (PEL) [Proposed]
4) Pentane, all isomers	TWA 600 (ppm) from ACGIH (TLV) TWA 1000 (ppm) from OSHA (PEL)
5) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA 1000 (ppm) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible gas and vapor; white frost at release point	Odor	Faint, unpleasant.
Specific Gravity	0.55 to 0.59 (Water = 1)	pH	Not applicable	Vapor Density	2.0 to 2.5 (Air = 1)
Boiling Point/Range	-42° to 36°C (-44° to 97°F) at 14.7 psia [ASTM D-2887]			Melting/Freezing Point	-188° to -130°C (-305° to -202°F) at 14.7 psia
Vapor Pressure	15 to 190 psia at 40°C (104°F)			Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Slightly soluble in cold water			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = 20,900 to 21,500 Btu/lb or 2,300 to 3,700 Btu/cu ft.; Dry Point Temperature = AP 82°F (28°C) [ASTM D-86]; Average Density at 60°F = ~ 5.0 lbs./gallon [ASTM D-2161].				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Propylene: GAS (LC₅₀): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse]. GAS (TC_{Lo}): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.</p> <p>iso-Butane: GAS (TC_{Lo}): Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement. GAS (LC₅₀): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p> <p>iso-Butene (Isobutylene or 2-Methylpropene): GAS (LC₅₀): Acute: 415 gm/m³ for 2 hours [Mouse]. GAS (LC₅₀): Acute: 620 gm/m³ for 4 hours [Rat].</p> <p>n-Butane: GAS (LC₅₀): Acute: 658,000 mg/m³ for 4 hours [Rat]. GAS (LC₅₀): Acute: 680,000 mg/m³ for 2 hours [Mouse].</p> <p>n-Pentane: GAS (LC₅₀): Acute: 364,000 mg/m³ for 4 hours [Rat] - Excitement.</p>
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Light Overhead Liquids

INTRAVENOUS (LD₅₀) Acute 446 mg/kg [Mouse]

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on liquefied petroleum gas, no deaths occurred, however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline)

in humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to **propylene** may entail a possible hazard from the formation of a reactive metabolite, **propylene oxide**, which is a "suspect human carcinogen". However, propylene have not been shown to be carcinogenic in rat studies. For example, propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. **Propylene** is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane** and **n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane** and **butenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

Inhalation of 500 ppm of **isopentane** or **n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects, however, higher exposure concentrations of 90,000 to 120,000 ppm (9 to 12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. **n-Pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure. Rat 28-day feeding studies on both isopentane and n-pentane using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the ethylene, propylene, and butene components of this material will readily vaporize and may contribute to generation of atmospheric smog.

Environmental Fate

The atmospheric half-lives of **propane**, **propylene**, and **butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours. Experimental data shows that significant photooxidation of **propylene** and **butenes** occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. The **pentanes** have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of **propane**, **isobutane**, and **n-butane** in air (< 8%) are not considered to be environmentally significant.

Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (< 0.1%); and therefore, this material will not cause harm to aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

Light Overhead Liquids

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum gases, liquefied		
Hazard Class	DOT Class. 2.1 (Flammable gas).	Packing Group(s)	Not applicable.
		UN/NA ID	UN1075
Reportable Quantity	There are Reportable Quantity (RQ) substance components present in this material which require DOT HAZMAT bill-of-lading display		
Placards		Emergency Response Guide No.	115
		HAZMAT STCC No.	49 057 29
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. There are no chemical substances present in this material subject to this statute.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following component in concentrations which are at or above de minimis levels and it is listed as a "toxic chemical" in 40 CFR Part 372 pursuant to the requirements of Section 313: Propylene or Propene [CAS No. 115-07-1] concentration: 1 to 5%.

Light Overhead Liquids

CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This material does not contain any chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": Propylene (Propene), 1-Butene, Isobutylene, 1-Pentane, and n-Pentane. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), Butane, various Butenes, Isopentane (Butane, 2-methyl), various Pentenes, and n-Pentane.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 08/26/2002
Print Date Printed on 08/26/2002

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



FCCU Sour Propylene/Propane

Material Safety Data Sheet

Lyondell-CITGO Refining Company, Ltd.
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0042
Revision Date 12/23/1998

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquefied Gas		
Color	Colorless liquid, invisible vapor.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure

DANGER! Extremely flammable and poisonous gas/liquid; vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
Contains hydrogen sulfide (H₂S)!
May be harmful or fatal if inhaled or ingested! High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation!
Mist or vapor may cause eye, skin, mucous membrane, and respiratory tract irritation and inflammation!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Liquid or compressed gas contact may cause frostbite or freeze burns!
Corrosive to some metals!

Hazard Rankings

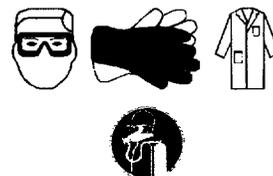
	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

COR

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	FCCU Sour Propylene/Propane	Technical Contact	(800) 525-4692
Product Number	068131759	Medical Emergency	(800) 313-7645
CAS Number	68131-75-9	CHEMTREC Emergency	(800) 424-9300
Product Family	Sour Gas		
Synonyms	FCCU Sour P/P Stream; FCCU Untreated Propylene/Propane Stream; Sour P/Ps from the Fluid Catalytic Cracker Unit; Sour Liquefied Petroleum Gas or Sour LP-Gas; C3-C4 Mix with Hydrogen Sulfide		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Sour C3-C4 Catalytic Cracked Hydrocarbons	68131-75-9	100
2) Propylene	115-07-1	70-80
3) Propane	000074-98-6	20-25
4) Hydrogen sulfide	7783-06-4	1-5
5) Iso-Butane	75-28-5	1-3
6) Butenes or Butylenes	25167-67-3	1-2
7) N-Butane	106-97-8	0-2

FCCU Sour Propylene/Propane

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health At concentrations above 500 ppm, H ₂ S causes unconsciousness and respiratory paralysis leading to coma and/or death (See Section 11.)
	Additionally, one or more components of this gas mixture is a "simple asphyxiant". High concentrations of this gas can displace the amount of oxygen available to breathe below that level necessary to sustain life. Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, weakness, nausea, vomiting, loss of coordination, unconsciousness, and coma, depending upon the concentration level and duration of exposure
Eye Contact	Vapors may cause moderate to severe eye irritation and photophobia (light sensitivity) upon short-term exposure <i>Severity depends upon the concentrations of hydrogen sulfide and duration of exposure.</i> Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with an expanding gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Hydrogen sulfide can be absorbed through the skin to produce toxic effects
Ingestion	Ingestion is not an applicable route of exposure for gases.
Chronic Health Effects Summary	Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures (See Section 11)
Conditions Aggravated by Exposure	Chronic inhalation to components of this gas (propane and n-butane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of Epinephrine (Adrenaline)-like drugs.
Target Organs	Personnel with eye, skin, cardiac, pulmonary, liver, kidney, or neurological disorders, high blood pressure, and those with a compromised ability to use oxygen (asthmatics, anemics, etc.) should take additional precautions to minimize or avoid exposure
Carcinogenic Potential	The substance is toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, and possibly, the endocrine and reproductive systems
	This product does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

FCCU Sour Propylene/Propane

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas		
Flash Point/Method	CLOSED CUP AP -107° to -73°C (-160° to -100°F). (Estimated)		
Lower Flammable Limit	AP 1.6 %	Upper Flammable Limit	AP 45 %
Auto-Ignition Temp.	AP 260°C (500°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur		
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

FCCU Sour Propylene/Propane

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow the substance to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Prevent this material's entry into waterways, sewers, basements, or confined areas. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor, it contains hydrogen sulfide (H₂S). This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

FCCU Sour Propylene/Propane

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls	Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H ₂ S is routinely stored or handled, install monitoring equipment or system with alarms.
Personal Protective Equipment	Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.
	
Eye Protection	Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
Hand Protection	Use neoprene or PCV/nitrile gloves. When handling materials that can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves.
Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this gas may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Odor is an inadequate warning for hazardous air concentrations. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV)
2) Liquefied Petroleum Gases	TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL)
3) Propylene	TWA: 1000 (ppm) from ACGIH (TLV) [1998]
4) Propane	TWA: 1000 (ppm) from OSHA (PEL) [1989]
5) Butanes	Simple asphyxiant.
	TWA: 2500 (ppm) from ACGIH (TLV) [1998]
	TWA: 1000 (ppm) from OSHA (PEL) [1989]
	TWA: 800 (ppm) from ACGIH (TLV) [1998]
	TWA: 800 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible vapor	Odor	Strong, foul smelling, rotten egg odor is unreliable as a warning of possible exposure
Specific Gravity	AP 0.55 to 0.60 (Water = 1)	pH	Acidic when exposed to air or moisture.	Vapor Density	AP 1.5 (Air = 1)
Boiling Point/Range	AP -60° to -1°C (-75° to 31°F) (by ASTM D-2887)	Melting/Freezing Point			AP -187° to -82°C (-305° to -117°F) at 14.7 psia.
Vapor Pressure	50 to 190 psia at 100°F.	Viscosity (cSt @ 40°C)			Not applicable

FCCU Sour Propylene/Propane

Solubility in Water	Moderately soluble in cold water.	Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 21,000 Btu/lb or 2,500 Btu/cu.ft.		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen sulfide

GAS (TCLo): Acute: 10 ppm for 15 minutes (Human) - Eye irritation
 GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation
 GAS (LC100): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death.
 GAS (LCLo): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.

Propylene:

GAS (LC50): Chronic 1,250 ppm for 6 hours/day for 14 weeks [Mouse]
 GAS (TCLo): Chronic 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response

iso-Butane:

GAS (TCLo): Acute: 1,040 gm/m3 for 2 hours [Mouse] - Excitement.
 GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress

n-Butane

GAS (LC50): Acute: 660 gm/m3 for 4 hour(s) [Rat].
 GAS (LC50) Acute. 680 gm/m3 for 2 hours [Mouse].

Hydrogen sulfide (H₂S): H₂S causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Liquefied Petroleum Gases: When a 4-hour rabbit inhalation screen test was run on a liquefied petroleum gas, no deaths occurred, however, the animal's heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline)

Propane Exposure to 1,000 ppm of propane for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs.

Propylene. In humans, at concentrations of 6-4% in air or higher, propylene causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications

FCCU Sour Propylene/Propane

Propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice; however, it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Butanes Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane** and **n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to both **butane** and **butylene** (additive effect), than the degree of narcosis exhibited following exposure to either gas alone.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage; however, hydrogen sulfide is moderately soluble in water so this material and any contaminated soil or water may be hazardous to human, animal, and aquatic life.
Environmental Fate	<p>Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%), and therefore, this material will not cause harm to aquatic life. These liquefied gas mixtures will normally evaporate rapidly if spilled. At ambient temperatures and pressure, the propylene, butenes, and hydrogen sulfide components of this material may contribute to generation of atmospheric smog.</p> <p>The atmospheric half-lives of propane, propylene, and butenes under photochemical smog conditions are estimated to be between 5 to 8 hours; and, experimental data shows that significant photooxidation of propylene occurs rapidly within 14 to 21 hours. The atmospheric half-lives of butanes under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of propane, isobutane, and n-butane in air (LT 8%) are not considered to be environmentally significant. Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increases the residence time.</p>

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide)		
Hazard Class	Class 2.3 Poisonous gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	A Reportable Quantity (RQ) has been established for the Hydrogen sulfide component of this material. (See Section 15.)		

FCCU Sour Propylene/Propane

Placards



Emergency Response Guide No.	119
HAZMAT STCC No.	49 057 66
MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances present in this product or refinery stream subject to this statute are: Hydrogen sulfide (CAS No. = 7783-06-4) concentration = 1 to 5 Wt.%.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2 This material would be classified under the following hazard categories: Fire Hazard, Reactive Hazard, Sudden Release of Pressure Hazard, and the Acute (Immediate) and Chronic (Delayed) Health Hazards.
SARA 313	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA. Propylene or Propene (CAS No. = 115-07-1) concentration = 70 to 80 Wt.%; Hydrogen sulfide (CAS No. = 7783-06-4) concentration = 1 to 5 Wt.%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream subject to this statute are. Hydrogen sulfide (RQ = 100 lbs. [45.36 kg]) concentration = 1 to 5 Wt.%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA) Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802
California Proposition 65	The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) requires warning be given for ingredients known to the State of California to cause cancer, birth defects, or other reproductive toxicity. This product does not contain any known chemical substances subject to this statute.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component in this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare" Propylene (Propene) In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds Substances present in this product which are subject to this statute are: Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), Butenes, Butane, and Hydrogen Sulfide

FCCU Sour Propylene/Propane**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 12/23/1998
Print Date Printed on 12/23/1998.

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Propylene - FCCU Grade

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0043
Revision Date 01/18/2002

Hazard Rankings		
	HMIS	NFPA
Health Hazard	1	1
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview			
Physical State	Liquefied gas		
Color	Colorless liquid, invisible vapor	Odor	Faint, unpleasant, hydrocarbon
DANGER! Extremely flammable compressed gas/liquid; vapor may cause flash fire or explosion.			
High pressure and rapid diffusion hazard.			
High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation.			
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats).			
Liquid or compressed gas contact may cause frostbite or freeze burns.			

Protective Equipment
Minimum Requirements See Section 8 for Details

SECTION 1: IDENTIFICATION

Trade Name	Propylene - FCCU Grade	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	68131759*	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	68131-75-9	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)		
Synonyms	Fluid Catalytic Cracker Unit-grade, Low-Sulfur, Liquefied Propylene, Technical-grade Propylene, Propene, 1-Propene, Methyl Ethene, Methyl Ethylene, Propene/Propane Mix, Methyl Ethene or Methyl Ethylene/Propane Mix, C3 Olefin/Paraffin Mix		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) C3-C4 Catalytic Cracked Hydrocarbons	68131-75-9	100
2) C3-C4 Hydrocarbons, C3-Rich	68476-49-3	100
3) Liquefied Petroleum Gases	68476-85-7	100
4) Propylene	115-07-1	70-80
5) Propane	74-98-6	18-28
6) Iso-Butane	75-28-5	1-3
7) Butenes or Butylenes	25167-67-3	1-2
8) n-Butane	106-97-8	0-2

Propylene - FCCU Grade

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation Skin contact. Eye contact.

Signs and Symptoms of Acute Exposure

Inhalation	One or more components of this gas mixture are "simple asphyxiants" (see Section 8) Their vapors can displace the amount of oxygen in air available to breathe below that necessary to sustain life, especially if working in confined spaces. Breathing vapors may also irritate the respiratory tract and cause central nervous system (CNS) depression Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, blurred vision, memory loss, drowsiness, fatigue, rapid or difficult breathing, confusion, vertigo, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure
Eye Contact	This gas is non-irritating, however, direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn "
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns
Ingestion	Ingestion is not an applicable route of exposure for gases
Chronic Health Effects Summary	Chronic inhalation to components of this gas (propane and propylene) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of Epinephrine (Adrenaline)-like drugs
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, or cardiovascular conditions should avoid exposure Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of "simple asphyxiants"
Target Organs	This material causes damage to the following organs: central nervous system (CNS), heart, skin, mucous membranes, and eyes.
Carcinogenic Potential	This material does not contain any components at concentrations at or above 0.1% which are considered carcinogenic by OSHA or NTP It does contain Propylene which is classified as "3" (Not classifiable for humans) by IARC and "A4" (Not classifiable for humans or animals) by ACGIH

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband If the individual is not breathing, immediately begin rescue breathing If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR) If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual Seek medical attention immediately
Eye Contact	If tissue is frozen, immediately seek medical attention If tissue is not frozen, check for and remove contact lenses Then, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible. Do not use eye ointment unless directed by a physician

Propylene - FCCU Grade

Skin Contact	In the event of frostbite or freeze burn, the affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F) DO NOT use dry heat or hot water Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	<p>If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended</p> <p>This material may also make the heart more susceptible to arrhythmias. Catecholamines such as epinephrine and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution If used, monitor the heart action closely Consider use of other drugs with less arrhythmogenic potential</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas		
Flash Point Method	CLOSED CUP AP -107°C (-160°F) (Estimated)		
Lower Flammable Limit	AP 2.0 %	Upper Flammable Limit	AP 11.1 %
Autoignition Temperature	AP 450°C (842°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, unburned hydrocarbon vapors, and trace oxides of sulfur		
Special Properties	This gas is flammable at well below ambient temperatures and readily forms flammable mixtures with air Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard Evacuate all non-essential personnel to an area upwind Remove all potential ignition sources Safety stop the source gas flow using non-sparking tools Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres Closed gas systems form white-colored frost at the point of a leak A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse Water spray may be used to reduce vapors Avoid entering a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions Secure the area and control access Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations Allow free liquid to evaporate or burn off This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source Some releases must be reported to the National Response Center (800/424-8802)

Propylene - FCCU Grade

SECTION 7: HANDLING AND STORAGE

Handling

This gas mixture contains "simple asphyxiants" Odor is not an adequate warning of potentially hazardous air concentrations Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release Use a pressure-reducing regulator when connecting to lower pressure piping systems Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area Eliminate heat and other ignition sources Use non-sparking and explosion-proof equipment Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 Do not allow vaporizing material to contact eyes, skin or other tissues Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated

Storage

Do not store this material near heat or any other potential ignition sources Segregate from oxidizers and other combustible materials by a distance of at least 20 feet Do not store this product in unlabeled containers Keep containers tightly closed.

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas Store and use these cylinders or other containers in a cool, well-ventilated place Storage areas should not exceed 100°F Protect from dampness, salt, or corrosive chemicals Do not drag, roll, or slide cylinders Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Both local exhaust and general room ventilation may be essential in work areas to prevent accumulation of potentially explosive gas/air mixtures If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection Ensure that an emergency eye wash station and safety shower are located near the work-station location

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations The following pictograms represent the minimum requirements for personal protective equipment For certain operations, additional PPE may be required



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases Safety glasses equipped with side shields or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors

Body Protection

Prevent potential skin contact with cold liquid, solid, or vapors Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.) Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids

Propylene - FCCU Grade

Respiratory Protection Odor is not an adequate warning for potentially hazardous air concentrations. For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments For an explanation about some of the occupational exposure limits shown below, refer to the definition of "Simple Asphyxiant" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current **Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents** handbook. Releases of these gases can result in dangerous conditions such as fire and explosive hazards, or atmospheres with inadequate amounts of oxygen to breathe (i.e., less than 19.5 Vol % oxygen in air). DO NOT ENTER such areas or confined spaces without special safety procedures including appropriate monitoring for flammability and oxygen deficiency.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Propylene	Simple asphyxiant
2) Liquefied Petroleum Gases	TWA 1000 (ppm) from ACGIH (TLV) TWA 1000 (ppm) from OSHA (PEL)
3) Propane	TWA 2500 (ppm) from ACGIH (TLV) TWA 1000 (ppm) from OSHA (PEL)
4) Butanes	TWA 800 (ppm) from ACGIH (TLV) TWA 800 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied gas	Color	Colorless liquid, invisible vapor	Odor	Faint, unpleasant, hydrocarbon
Specific Gravity	0.53 (Water = 1)	pH	Not applicable	Vapor Density	1.45-1.5 (Air = 1)
Boiling Point/Range	-48° to -9°C (-55° to 15°F) at 14.7 psia (ASTM D-2887)			Melting/Freezing Point	AP -170°C (-275°F) at 14.7 psia
Vapor Pressure	205 to 230 psia at 40°C (104°F)			Viscosity (cSt @ 40°C)	Not applicable
Solubility in Water	Slightly soluble in cold water			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 21,500 Btu/lb or 2,185 Btu/cu ft Dry Point Temperature = AP 11°F (-12°C) (ASTM D-86), Density of the Liquid at 60°F = 4.23 to 4.70 lbs/gal in a vacuum				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

Propylene - FCCU Grade

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Propylene:

GAS (LC50) Chronic 1,250 ppm for 6 hours/day for 14 weeks [Mouse]
 GAS (TCLo) Chronic 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response

Iso-Butane:

GAS (TCLo) Acute 1,040 gm/m³ for 2 hours [Mouse] - Excitement
 GAS (LC50) Acute 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress

Iso-Butene (Isobutylene or 2-Methylpropene):

GAS (LC50) Acute 415 gm/m³ for 2 hours [Mouse]
 GAS (LC50) Acute 620 gm/m³ for 4 hours [Rat]

n-Butane:

GAS (LC50) Acute 660,000 mg/m³ for 4 hour(s) [Rat]
 GAS (LC50) Acute 680,000 mg/m³ for 2 hours [Mouse]

Liquefied Petroleum Gases:

When a 4-hour rabbit inhalation screen test was run on a liquefied petroleum gas, no deaths occurred, however, the animal's heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline)

Propylene:

In humans, at concentrations of 6.4% in air or higher, Propylene causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice, however, it may be partially metabolized to propylene oxide which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Propane:

Exposure to 1,000 ppm of propane for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol % in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs.

Iso-butane:

Laboratory animals have exhibited a higher degree of narcosis when exposed to both isobutane and butylene (additive effect), than the degree of narcosis exhibited following exposure to either gas alone.

n-Butane:

An n-butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Also, butane may decrease the myocardial threshold to epinephrine-induced arrhythmias.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage.

Propylene - FCCU Grade

Environmental Fate

Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%), and therefore, this material will not cause harm to aquatic life. These liquefied gas mixtures will normally evaporate rapidly if spilled. At ambient temperatures and pressure, the **propylene** component of this material will readily vaporize and may contribute to generation of atmospheric smog.

The atmospheric half-lives of **propane, propylene, and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours, and, experimental data shows that significant photooxidation of propylene occurs rapidly within 14 to 21 hours. The atmospheric half-lives of **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of propane, isobutane, and n-butane in air (LT 8%) are not considered to be environmentally significant.

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U S Department of Transportation (DOT) regulated material		
Proper Shipping Name	Petroleum gases, liquefied (or Propylene)		
Hazard Class	DOT Class: 2.1 (Flammable gas)	Packing Group(s)	Not applicable
		UN/NA ID	UN1075 (or UN1077)
Reportable Quantity	A Reportable Quantity (RQ) has not been established for any components of this material		
Placards		Emergency Response Guide No.	115
		HAZMAT STCC No.	49 057 66
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, and Acute (Immediate) Health Hazard.
SARA 313	This material contains the following component in concentrations above de minimis levels and it is listed as "Toxic Chemical" in 40 CFR Part 372 pursuant to the requirements of Section 313: Propylene or Propene (CAS No. 115-07-1) concentration = 70 to 80 Wt.%.

Propylene - FCCU Grade

CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This product or refinery stream is not known to contain chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This stream does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component in this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare" Propylene (Propene) . In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this product which are subject to this statute are Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, and n-Butane .

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 01/18/2002
Print Date Printed on 01/18/2002

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists				AIHA = American Industrial Hygiene Association		
IARC = International Agency for Research on Cancer				NTP = National Toxicology Program		
NIOSH = National Institute of Occupational Safety and Health				OSHA = Occupational Safety and Health Administration		
NPCA = National Paint and Coating Manufacturers Association				HMIS = Hazardous Materials Information System		
NFPA = National Fire Protection Association				EPA = Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



BRU No. 2 Deisobutanizer Tower Overhead Stream

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0044
Revision Date 06/01/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquefied Gas.		
Color	Colorless liquid, invisible gas and vapor; white frost at release point.	Odor	Strong, unpleasant, and distinctive of rotten cabbage.

DANGER! Extremely flammable compressed liquefied gas;
vapor may cause flash fire or explosion!
May form explosive peroxides on exposure to air!
High pressure and rapid diffusion hazard!
Liquid or compressed gas contact may cause frostbite or freeze burns!
May be harmful or fatal if inhaled or absorbed through the skin!
High concentrations of vapor reduce oxygen available for breathing and
may cause central nervous system (CNS) depression or suffocation!
Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats)!
Overexposures may cause target organ effects such as lung, heart,
central nervous system, blood, liver, and/or kidney damage!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	BRU No. 2 Deisobutanizer Tower Overhead Stream	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110044	Medical Emergency	(918) 495-4700
CAS Number	68477-33-8 or 68477-69-0	CHEMTREC Emergency	(800) 424-9300
Product Family	Isobutane-Rich Liquefied Petroleum Gas		
Synonyms	Butane Recovery Unit Deisobutanizer Tower Overhead; B/B Caustic Pretreater Feed; Unsweetened Technical-grade Isobutane; Unsweetened IC4 Stock; Unsweetened IC4-Rich LPG; Partially-refined IC4-Rich Liquefied Petroleum Gas, LPG containing Methyl Mercaptan; C3-C4 Hydrocarbons and CH3-SH		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) C3-C4 Hydrocarbons, Isobutane-Rich, Distillates (Petroleum)	68477-33-4	100
2) Butane Splitter Overhead Gases (Petroleum)	68477-69-0	100
3) Liquefied Petroleum Gases	68476-85-7	100
4) Iso-Butane	75-28-5	50-96
5) Butenes or Butylenes	25167-67-3	1-20
6) Isobutylene	115-11-7	1-20
7) n-Butane	106-97-8	1-20
8) Propane	74-98-6	1-10
9) Propylene	115-07-1	0-2
10) Methyl mercaptan	74-93-1	0.1-0.5

**BRU No. 2 Deisobutanizer
Tower Overhead Stream**

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation Eye contact. Skin contact Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 150 ppm or more of methyl mercaptan are immediately dangerous to life and health. At concentrations above 700 ppm, it may cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11)
	Additionally, at least one of the components of this liquefied gas is a "simple asphyxiant" (See Section 8). High concentrations of this material can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Vapors may cause mild to severe eye irritation upon short-term exposure. Severity depends upon the concentration of methyl mercaptan and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with an expanding liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Methyl mercaptan can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus.
Chronic Health Effects Summary	Chronic inhalation of this material's components (propane, propylene, and n-butane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline) -like drugs.
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.
Target Organs	This stream is toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, blood, and possibly, the liver and kidneys.
Carcinogenic Potential	This refinery stream does not contain any components at concentrations at or above 0.1% which are considered carcinogenic by OSHA, IARC, and NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

**BRU No. 2 Deisobutanizer
Tower Overhead Stream**

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Liquefied Gas.		
Flash Point/Method	CLOSED CUP: AP -107° to -83°C (-160° to -118°F) (Estimated)		
Lower Flammable Limit	AP 1.6 %	Upper Flammable Limit	AP 21.8 %
Auto-Ignition Temp.	AP 343°C (650°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans.		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide, and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

**BRU No. 2 Deisobutanizer
Tower Overhead Stream**

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it contains **methyl mercaptan and simple asphyxiants**. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 and wear appropriate personal protective clothing/equipment. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

BRU No. 2 Deisobutanizer Tower Overhead Stream

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposures, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.

Body Protection Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable liquefied gases. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol % in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against methyl mercaptan and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Methyl mercaptan	TWA: 5 (ppm) from ACGIH (TLV) [1997] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998] TWA: 0.5 CEIL 10 (ppm) from OSHA [1989]
2) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989] Simple asphyxiant.
3) Propylene	TWA: 2500 (ppm) from ACGIH (TLV) [1998]
4) Propane	TWA: 1000 (ppm) from OSHA (PEL) [1989]
5) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1998] TWA: 800 (ppm) from OSHA (PEL) [1989]

**BRU No. 2 Deisobutanizer
Tower Overhead Stream**

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, unpleasant, and distinctive of rotten cabbage
Specific Gravity	AP 0.56 to 0.58 (Water = 1)	pH	Not applicable	Vapor Density	AP 2.0 (Air = 1)
Boiling Point/Range	AP -48°C to 5°C (-54° to 42°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			AP -187° to -83°C (-305° to -117°F) at 14.7 psia.
Vapor Pressure	50 to 75 psia at 40°C (104°F)	Viscosity (cSt @ 40°C)			Not applicable.
Solubility in Water	Moderately soluble in cold water.	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 21,100 Btu/lb or 3,250 Btu/cu.ft.; Dry Point Temperature = AP 21°F (-6°C) (ASTM D-86); Average Density at 60°F = AP 5.00 lbs./gal (ASTM D-2161)				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Methanethiol (Methyl mercaptan). GAS (LC50) Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration. GAS (LC50) Acute: 6,530 ug/m³ for 2 hours [Mouse].</p> <p>Propylene: GAS (LC50). Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse]. GAS (TCLo): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.</p> <p>Iso-Butane: GAS (TCLo) Acute: 1,040,000 mg/m³ for 2 hours [Mouse] - Excitement. GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress</p> <p>Iso-Butene (Isobutylene or 2-Methylpropene): GAS (LC50). Acute. 415,000 mg/m³ for 2 hours [Mouse]. GAS (LC50) Acute 620,000 mg/m³ for 4 hours [Rat]</p> <p>n-Butane: GAS (LC50): Acute: 660,000 mg/m³ for 4 hours [Rat] GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse].</p>
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Methyl mercaptan acts as respiratory poison by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, it can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. It is also an eye irritant and has been shown to produce positive responses in various mutagenic assays.

Exposure to 1,000 ppm of propane for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs.

BRU No. 2 Deisobutanizer Tower Overhead Stream

When a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). **Propylene** has also been found to be a cardiac sensitizer in dogs. An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias.

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice, however, it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane** and **n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage, however, at ambient temperatures and pressure, the **propane, propylene, butenes, and methyl mercaptan** components of this stream may contribute to generation of atmospheric smog. The atmospheric half-lives of **propane, propylene, and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours. Experimental data shows that significant photooxidation of **propylene** occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **propane, isobutane, and n-butane** in air (LT 8%) are not considered to be environmentally significant.

Environmental Fate

Liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%), however, the toxic **methyl mercaptan** component is moderately soluble in water. Therefore, this material could potentially cause harm to aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**BRU No. 2 Deisobutanizer
Tower Overhead Stream**

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Methyl mercaptan)		
Hazard Class	Class 2.3 Poisonous gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance component present in this material which might require DOT HAZMAT bill-of-lading display is Methyl mercaptan .		
Placards			Emergency Response Guide No. 119
		HAZMAT STCC No.	49 203 78
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This stream and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance which might be present in these streams and is subject to this statute is: Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] .
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This stream contains the following component in concentrations which might be at or above de minimis levels and it is listed as a toxic chemical in 40 CFR Part 372 pursuant to the requirements of Section 313: Propylene or Propene [CAS No. 115-07-1] concentration: 0 to 2%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance that might be present in this stream which is subject to this statute is: Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 0.5%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This stream does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, they are not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in these streams as "Volatile Organic Compounds (VOC)" that contribute significantly to air pollution which endangers public health and welfare": Propylene (Propene), 1-Butene, and Isobutylene.

**BRU No. 2 Deisobutanizer
Tower Overhead Stream**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in this stream that are subject to this statute are: **Methyl mercaptan (Methanethiol), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, and n-Butane**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1 0
Revision Date 06/01/1999
Print Date Printed on 02/03/2000

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists				AIHA = American Industrial Hygiene Association		
IARC = International Agency for Research on Cancer				NTP = National Toxicology Program		
NIOSH = National Institute of Occupational Safety and Health				OSHA = Occupational Safety and Health Administration		
NPCA = National Paint and Coating Manufacturers Association				HMIS = Hazardous Materials Information System		
NFPA = National Fire Protection Association				EPA = Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



BRU No. 2 Stabilizer Tower Overhead Stream

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0045
Revision Date 03/30/2000

Hazard Rankings		
	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

IMPORTANT. Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

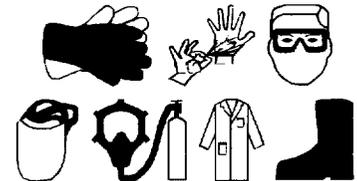
Emergency Overview

Physical State	Liquefied Gas		
Color	Colorless liquid, invisible gas and vapor, white frost at release point	Odor	Strong, unpleasant, and distinctive of skunk or rotten cabbage.

DANGER! Extremely flammable liquefied gas; vapor may cause flash fire or explosion!
May form explosive peroxides on exposure to air!
High pressure and rapid diffusion hazard!
Liquid or compressed gas contact may cause frostbite or freeze burns!
May be harmful or fatal if inhaled or absorbed through the skin!
High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation!
Vapor or mist may cause mild to severe eye, mucous membrane, and respiratory tract irritation and inflammation!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Overexposures may cause target organ effects such as lung, brain, central nervous system, heart, blood, liver, and/or kidney damage!
Contains low levels of 1,3-Butadiene! Based upon laboratory animal tests, cancer, mutagenic, and reproductive hazards might exist!
May cause blood system disorders and/or genetic damage!
May adversely affect reproduction or reproductive development!

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	BRU No. 2 Stabilizer Tower Overhead Stream	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110045	Medical Emergency	(918) 495-4700
CAS Number	Mixture—See Section 2	CHEMTREC Emergency	(800) 424-9300
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)		
Synonyms	BRU No. 2 Deisobutanizer Tower Feed; C3-C6 Olefin/Alkane Hydrocarbons and Mercaptans Mix; Untreated Butanes/Butenes-rich Gas, Untreated B/B Concentrate LPG or LP-Gas, Unsweetened LPG, Raw LPG, High-Sulfur, Liquefied Petroleum Gas, C4-Rich LPG containing Mercaptans; C3-C6 Hydrocarbons and R-SHs.		

BRU No. 2 Stabilizer Tower Overhead Stream

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Liquefied Petroleum Gases	68476-85-7	100
2) Saturate Gas Plant Mixed Stream, C4-Rich, Tail Gas	68478-32-0	100
3) C3-C6 Hydrocarbons	68513-26-8	98-100
4) n-Butane	106-97-8	40-62
5) Iso-Butane	75-28-5	30-47
6) Iso-Pentane	78-78-4	1-20
7) Butenes or Butylenes	25167-67-3	1-10
8) n-Pentane	109-66-0	1-5
9) Pentenes or Pentylenes	68527-11-7	0-5
10) 1,3-Butadiene	106-99-0	0 1-3
11) Isobutylene	115-11-7	0-3
12) Hexane Isomers	Mixture	0-2 5
13) Propane	74-98-6	0-1 5
14) Methyl mercaptan	74-93-1	0-1
15) Ethyl mercaptan	75-08-1	0-0.75
16) C3 Mercaptans	Mixture	0-0.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation Skin contact. Eye contact. Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 150 ppm or more of methyl mercaptan are immediately dangerous to life and health. At concentrations above 700 ppm, it may cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)</p> <p>High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.</p>
Eye Contact	Vapors may cause mild to severe eye irritation upon short-term exposure. Severity depends upon the concentration of mercaptans and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with an expanding liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Methyl mercaptan can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus.
Chronic Health Effects Summary	<p>Chronic inhalation to components of this gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.</p> <p>1,3-Butadiene (BD), a minor component of this stream, has been shown to be mutagenic and produces multiple organ tumors in various tissues of laboratory rodents. BD also causes sexual organ atrophy in test animals. (See Section 11.)</p>
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.

BRU No. 2 Stabilizer Tower Overhead Stream

Target Organs This stream is toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, and possibly, the liver, kidneys, bladder, and/or reproductive systems

Carcinogenic Potential This stream contains 1,3-butadiene at concentrations at or above 0.1%. **1,3-Butadiene** is considered carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Liquefied Gas.		
Flash Point Method	CLOSED CUP. LT -60° to -51°C (-76° to -60°F). (Estimated)		
Lower Flammable Limit	AP 1.4 %	Upper Flammable Limit	AP 21.8 %
Autoignition Temperature	AP 288°C (550°F)		

BRU No. 2 Stabilizer Tower Overhead Stream

Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling	Danger! Poisonous and Flammable Gas! Do NOT breathe vapor, it may contain mercaptans. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing, chemical splash goggles, and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including monitoring systems with alarms for oxygen deficiency and flammability.
	Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

BRU No. 2 Stabilizer Tower Overhead Stream

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 and wear appropriate personal protective clothing/equipment. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION**Engineering Controls**

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposures, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

**Eye Protection**

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol % in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against mercaptans.

BRU No. 2 Stabilizer Tower Overhead Stream**Occupational Exposure Guidelines**

Substance	Applicable Workplace Exposure Levels
1) Methyl mercaptan	TWA: 0.5 (ppm) from ACGIH (TLV) [1999] CEIL: 10 (ppm) from OSHA (PEL) [1989]
2) Ethyl mercaptan	TWA: 0.5 (ppm) from ACGIH (TLV) [1999] CEIL: 10 (ppm) from OSHA (PEL) [1989]
3) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1999] TWA: 1000 (ppm) from OSHA (PEL) [1989]
4) Propane	TWA: 2500 (ppm) from ACGIH (TLV) [1999] TWA: 1000 (ppm) from OSHA (PEL) [1989]
5) Butane	TWA: 800 (ppm) from ACGIH (TLV) [1999] TWA: 800 (ppm) from OSHA (PEL) [1989]
6) 1,3-Butadiene ("A2" & "Z-2" Suspected Human Carcinogen)	TWA: 2 (ppm) from ACGIH (TLV) [1999] TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [1994]
7) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) [1999] TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [1989] TWA: 1000 (ppm) from OSHA (PEL) [1976]
8) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [1999] TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid, invisible gas and vapor, white frost at release point	Odor	Strong, unpleasant, and distinctive of skunk or rotten cabbage.
Specific Gravity	AP 0.58 to 0.62 (Water = 1)	pH	Not applicable	Vapor Density	AP 2.0 to 2.3 (Air = 1)
Boiling Point/Range	AP -42° to 63°C (-43° to 146°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			AP -160° to -99°C (-255° to -147°F) at 14.7 psia
Vapor Pressure	AP 20 to 75 psia at 40°C (104°F)	Viscosity (cSt @ 40°C)			Not applicable.
Solubility in Water	Negligible to slightly soluble in cold water.	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard Gross Heat of Combustion at 60°F = AP 20,700 to 21,100 Btu/lb or 3,350 Btu/cu ft ; Dry Point Temperature = AP 121°F (49°C) (ASTM D-86); Average Density at 60°F = 5.0 lbs./gal (ASTM D-2161).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur, but possible.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS		

BRU No. 2 Stabilizer Tower Overhead Stream

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Methanethiol (Methyl mercaptan):

GAS (LC50): Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration
GAS (LC50): Acute: 6,530 ug/m³ for 2 hours [Mouse].

Ethanethiol (Ethyl mercaptan):

GAS (LC50): Acute: 2,770 ppm for 4 hours [Mouse] - Excitement, motor activity changes, and cyanosis
GAS (LC50): Acute: 4,420 ppm for 4 hours [Rat] - Excitement, spastic paraparesis, and cyanosis.
ORAL (LD50): Acute: 682 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.
INTRAPERITONEAL (LD50): Acute: 226 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis

1-Propanethiol (n-Propyl mercaptan)

GAS (LC50): Acute: 4,010 ppm for 4 hours [Mouse] - Respiratory stimulation, somnolence, and chromidracryorrhea.
GAS (LC50): Acute: 7,300 ppm for 4 hours [Rat] - Respiratory stimulation, somnolence, and lacrimation.
ORAL (LD50) Acute: 1,790 mg/kg [Rat] - Respiratory depression, somnolence, and coma
INTRAPERITONEAL (LD50): Acute: 515 mg/kg [Rat] - Respiratory depression, somnolence, and coma

iso-Butane:

GAS (TCLo): Acute: 1,040,000 mg/m³ for 2 hours [Mouse] - Excitement
GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

iso-Butene (isobutylene or 2-Methylpropene)

GAS (LC50): Acute: 415,000 mg/m³ for 2 hours [Mouse]
GAS (LC50) Acute: 620,000 mg/m³ for 4 hours [Rat]

n-Butane

GAS (LC50): Acute: 658,000 mg/m³ for 4 hours [Rat].
GAS (LC50). Acute: 680,000 mg/m³ for 2 hours [Mouse].

1,3-Butadiene (Erythrene or Pyrrolyene):

GAS (LC50) Acute: 285,000 mg/m³ for 4 hour(s) [Rat]
GAS (LC50): Acute: 270,000 mg/m³ for 2 hours [Mouse].
ORAL (LD50): Acute: 5,480 mg/kg [Rat]

2,2-Dimethylpropane (Neopentane):

INTRAPERITONEAL (LD50): Acute: 100 mg/kg [Mouse]

n-Pentane:

GAS (LC50): Acute: 364,000 mg/m³ for 4 hours [Rat] - Excitement.
INTRAVENOUS (LD50). Acute: 446 mg/kg [Mouse]

Methyl and ethyl mercaptans act as respiratory poisons by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, they can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They are also eye irritants and have been shown to produce positive responses in various mutagenic assays. **Propyl mercaptans** possess similar toxic properties but at somewhat higher exposure levels.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred, however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline)

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane and n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane, butylene, and/or 1,3-butadiene** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

At very high concentrations, **1,3-butadiene (BD)** produces narcosis with central nervous system depression and/or respiratory paralysis. Lifetime inhalation studies have shown that BD or its epoxide metabolites cause multiple organ tumors in various tissues of both rats and mice. It is also a mutagen and causes sexual organ atrophy in test animals. Epidemiology studies amongst BD workers and styrene-butadiene rubber (SBR) workers suggest that BD or BD epoxide metabolite exposures may increase the risk of cancers of the lymphohematopoietic system. Based on these various studies, IARC, NTP, OSHA, ACGIH, and EPA have determined BD to be an "animal carcinogen" and a "probable human carcinogen"

BRU No. 2 Stabilizer Tower Overhead Stream

Inhalation of 500 ppm of **isopentane** or **n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects, however, higher exposure concentrations of 90,000 to 120,000 ppm (9 to 12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. **n-Pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure. Rat 28-day feeding studies on both **isopentane** and **n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic

SECTION 12: ECOLOGICAL INFORMATION**Ecotoxicity**

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **butenes**, **pentenes**, and **1,3-butadiene** components of this material will readily vaporize and may contribute to generation of atmospheric smog. The atmospheric half-lives of **propane**, **butenes**, and **pentenes** under photochemical smog conditions are estimated to be between 5 to 8 hours; and, **1,3-butadiene's** half-life is only 2 to 3 hours. Experimental data shows that significant photooxidation of **1,3-butadiene** occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. The **pentanes** have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of **propane**, **isobutane**, and **n-butane** in air (LT 8%) is not considered to be environmentally significant.

Environmental Fate

Liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%), however, the toxic **methyl and ethyl mercaptan** components are moderately soluble in water. Therefore, this material could potentially cause harm to aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (U153) characteristics. In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s. (Butanes, Pentanes) Inhalation Hazard Zone B (Methyl mercaptan)		
Hazard Class	DOT CLASS: Poisonous gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance component present in this material which might require DOT HAZMAT bill-of-lading display is Methyl mercaptan		

BRU No. 2 Stabilizer Tower Overhead Stream**Placards**

Emergency Response Guide No. 119

HAZMAT STCC No.

49 203 78

MARPOL III Status

Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This stream and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance which might be present in these streams and is subject to this statute is Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] .
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This refinery stream contains the following component in concentrations which are at or above de minimis levels and it is listed as toxic chemical in 40 CFR Part 372 pursuant to the requirements of Section 313: 1,3-Butadiene [CAS No. 106-99-0] concentration: 0.1 to 3%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4 As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4 A chemical substance that might be present in this material and subject to this statute is: Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 1%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains the following chemical substance which is known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: 1,3-Butadiene [CAS No. = 106-99-0]
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": 1,3-Butadiene, 1-Butene, Isobutylene, 1-Pentene, and n-Pentane. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in this stream that are subject to this statute are: Methyl mercaptan (Methanethiol), Ethyl mercaptan (Ethanethiol), Propane, Isobutane (Propane, 2-methyl), various Butenes, Butane, 1,3-Butadiene, Isopentane (Butane, 2-methyl), various Pentenes, and n-Pentane.

BRU No. 2 Stabilizer Tower Overhead Stream**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 03/30/2000
Print Date Printed on 04/12/2000

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0046
HFR# 240

637 HDS Feed

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0046
Revision Date 2/25/2005

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Emergency Overview

Physical State Liquid.
Color Amber to dark amber **Odor** Hydrocarbon. Rotten eggs.
(Strong.)

DANGER!
Extremely Flammable and Poisonous.
Contains hydrogen sulfide gas. May be fatal if inhaled.
Vapor may cause flash fire or explosion.
Vapor may travel considerable distance to source of ignition and flash back.
Harmful or fatal if swallowed - Can enter lungs and cause damage.
Repeated or excessive exposure to certain components of this mixture have been associated with central nervous system effects.
Harmful to aquatic organisms.
Possible Cancer Hazard (See Section 3)

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	637 HDS Feed	Technical Contact	
Product Number	Not available.	Medical Emergency	
CAS Number	Mixture.	CHEMTREC Emergency	(800) 424-9300
		(United States Only)	
Product Family	Not applicable.		
Synonyms	637 HDS Combined Feed, ScanFiner Feed		

SECTION 2. COMPOSITION (TYPICAL)

This product may be composed, in whole or in part, of any of the following refinery streams:

Light Thermal Cracked Naphtha (Petroleum) [CAS No.: 64741-74-8]
Light Catalytic Cracked Naphtha [CAS No.: 64741-55-5]

This product contains the following chemicals as components of the refinery streams listed above:

Component Name(s)	CAS Registry No.	Concentration (%)
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637 HDS Feed

Hexane, other isomers	Mixture	5.7 - 17.8
C6-C9 alpha-Alkenes	68526-99-8	4.72 - 14.65
n-Hexane	110-54-3	1.91 - 11.75
Cyclohexane	110-82-7	1 - 5
Benzene	71-43-2	1 - 4.86
Hydrocarbons, C5-Rich	68476-55-1	2.1 - 3.5
Toluene	108-88-3	0.93 - 4.65
Butenes or Butylenes	25167-67-3	0.93 - 4.65
Xylene, all isomers	1330-20-7	0.93 - 4.51
Octanes, all isomers	Mixture	0.93 - 4.51
1, 3-Butadiene	106-99-0	<1
Trimethylbenzenes, all isomers	25551-13-7	0.43 - 1.29
Ethylmethylbenzene, all isomers	25550-14-5	0.43 - 1.29
Methylcyclopentane	96-37-7	0.07 - 1.4
Heptane, all isomers	Mixture	0.35 - 1.05
Pentanes, all isomers	Mixture	0.07 - 1.05
Butanes	Mixture	0.07 - 1.05
Ethylbenzene	100-41-4	0.172 - 0.86
Hydrogen Sulfide	7783-06-4	<0.2

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled. Contains hydrogen sulfide. Inhalation of gas or vapor may cause severe nose, throat, respiratory tract, and lung irritation, respiratory paralysis, and death, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.
Eye Contact	This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.
Skin Contact	May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.
Ingestion	Swallowing this material may be harmful. Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea. This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).
Chronic Health Effects Summary	Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea. Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers. Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis. This material, or a component of this material, has been shown to cause cancer in laboratory

637 HDS Feed

animals. However it is not likely to represent a human cancer hazard.
See Toxicological Information (Section 11)

- Conditions Aggravated by Exposure** Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Peripheral Nervous System, Central Nervous System (CNS), Heart (Cardiac)
- Target Organs** Contains material which may cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, , bone marrow, central nervous system (CNS), eye, lens or cornea, testes.
- Carcinogenic Potential** **CARCINOGENIC EFFECTS** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified + (Proven.) by OSHA+ (Proven.) by NIOSH [1, 3-Butadiene]. Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [1, 3-Butadiene]. Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
- Skin Contact** Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
- Ingestion** Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.
- Notes to Physician** INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

637 HDS Feed

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IB flammable liquid.		
Flash Point	Open cup: <-45°C (-49°F).		
Lower Flammable Limit	AP 2 %	Upper Flammable Limit	Not Available
Autoignition Temperature	The lowest known value is 225°C (437°F) (n-Hexane).		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.		
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid enter sewers or waterways.		

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or

637 HDS Feed

disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Do NOT use compressed air for filling, discharging or other handling operations.

Product container is not designed for elevated pressure. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Do not expose product containers to flames, sparks, heat or other potential ignition sources. Empty containers may contain product residues that can ignite with explosive force. Observe label precautions. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C). All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable regulatory requirements and the National Electrical Code.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

637 HDS Feed

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



- Eye Protection** Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.
- Hand Protection** Avoid skin contact. Use heavy duty gloves constructed of chemical resistant materials such as Viton® or heavy nitrile rubber. Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.
- Body Protection** Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
C6-C9 alpha-Alkenes n-Hexane	Not available. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Cyclohexane	ACGIH (United States). TWA: 100 ppm 8 hour(s). OSHA (United States). TWA: 300 ppm 8 hour(s).
Benzene	ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Hydrocarbons, C5-Rich Toluene	Not available. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Butenes or Butylenes Xylene, all isomers	Not available. ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s).

637 HDS Feed

Octanes, all isomers	OSHA (United States). TWA: 100 ppm 8 hour(s). ACGIH (United States). TWA: 300 ppm 8 hour(s).
1, 3-Butadiene	OSHA (United States). TWA: 500 ppm 8 hour(s). ACGIH (United States). Notes: "A2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). OSHA (United States). Notes: "Z-2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). Action Level: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Trimethylbenzenes, all isomers	ACGIH (United States). TWA: 25 ppm 8 hour(s).
Ethylmethylbenzene, all isomers	Not available.
Methylcyclopentane	Not available.
Heptane, all isomers	ACGIH (United States). TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s).
Pentanes, all isomers	OSHA (United States). TWA: 500 ppm 8 hour(s). ACGIH (United States). TWA: 600 ppm 8 hour(s).
Butanes	OSHA (United States). TWA: 1000 ppm 8 hour(s). ACGIH (United States). TWA: 800 ppm 8 hour(s).
Ethylbenzene	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s).
Hydrogen Sulfide	OSHA (United States). TWA: 100 ppm 8 hour(s). ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Light Thermal Cracked Naphtha (Petroleum)	Not available.
Light Aliphatic Naphthas, Sour (family)	Not available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Amber to dark amber	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	Weighted average: 0.75 (Water = 1)	pH	Not Applicable.	Vapor Density	The highest known value is 3.1 (Air = 1) (Toluene). Weighted average: 2.98 (Air = 1)
Boiling Range	The lowest known value is 69°C (156.2°F) (n-Hexane). Weighted average: 81.05°C (177.9°F)	Melting/Freezing Point			Not available.
Vapor Pressure	The highest known value is 16.5 kPa (124 mm Hg) (at 20°C) (n-Hexane). Weighted average: 8.4 kPa (63.01 mm Hg) (at 20°C)	Volatility			

637 HDS Feed

Solubility in Water	Very slightly soluble in cold water. (<0.1 % w/w)	Viscosity (cSt @ 40°C)	not available
Flash Point	Open cup: <-45°C (-49°F).		
Additional Properties	No additional information.		

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks and flame.		
Materials Incompatibility	Incompatible with strong acids, strong bases, and strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data**n-Hexane**

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Benzene

ORAL (LD50):	Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
INHALATION (LC50):	
(VAPOR):	Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a

637 HDS Feed

weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

1, 3-Butadiene

637 HDS Feed

ORAL (LD50): Acute: 5480 mg/kg [Rat].

Studies of Workers Exposed to Butadiene:

Studies show evidence that over-exposure may be associated with an increased incidence of cancers of lymphohematopoietic organ systems, including leukemia.

Studies in Laboratory Animals:

Studies indicate that prolonged, repeated exposure to high levels of butadiene can cause cancer in multiple organs including lymphohematopoietic organ systems.

Studies indicate that exposure to high levels of butadiene can cause chromosome damage to somatic and germ cells. Some studies also show limited evidence that exposure to butadiene may induce heritable mutations.

Studies show evidence of adverse effects on male and female reproductive organs following exposure to high levels of butadiene. Embryotoxicity has been reported. Effects included increased rates of fetal death and skeletal variations.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD50), Acute: 3,500 mg/kg [Rat].

DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Hydrogen Sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse].

Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations at or above 100 ppm are immediately dangerous to life and health.

SECTION 12. ECOLOGICAL INFORMATION**Ecotoxicity**

No data.

Environmental Fate

This product will normally float on water. Components will evaporate rapidly. This material may be harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. The log Kow value for this product is expected to be in the range of 3.3 to 6.

637 HDS Feed**SECTION 13. DISPOSAL CONSIDERATIONS**

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: n-Hexane [CAS No.: 110-54-3] Concentration: 6.8% Cyclohexane [CAS No.: 110-82-7] Concentration: 3% Benzene [CAS No.: 71-43-2] Concentration: 2.9% Toluene [CAS No.: 108-88-3] Concentration: 2.8% Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 2.7% Ethylbenzene [CAS No.: 100-41-4] Concentration: 0.5%

637 HDS Feed**CERCLA**

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:

n-Hexane [CAS No.: 110-54-3] RQ = 5000 lb. (2268 kg) Concentration: 6.8%
 Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lb. (453.6 kg) Concentration: 3%
 Benzene [CAS No.: 71-43-2] RQ = 10 lb. (4.536 kg) Concentration: 2.9%
 Toluene [CAS No.: 108-88-3] RQ = 1000 lb. (453.6 kg) Concentration: 2.8%
 Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lb. (45.36 kg) Concentration: 2.7%
 Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lb. (453.6 kg) Concentration: 0.516%
 Hydrogen Sulfide [CAS No.: 7783-06-4] RQ = 100 lb. (45.36 kg) Concentration: 0.18%

Clean Water Act (CWA)

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Benzene: 2.93%
 Toluene: 2.79%
 1, 3-Butadiene: 0.9%
 Ethylbenzene: 0.516%

New Jersey Right-to-Know Label

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

Additional Regulatory Remarks

No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 2/25/2005
Print Date Printed on 2/25/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienist				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR

637 HDS Feed

PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0047
HFR # 240

637 Feed to R1 & R2 Reactors

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0047
Revision Date 2/25/2005

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Biphasic (gas/liquid)
Color Amber to dark amber **Odor** Hydrocarbon. Rotten eggs.
(Strong.)

DANGER
EXTREMELY FLAMMABLE AND POISONOUS GAS.
Contains hydrogen sulfide gas.
May be fatal if inhaled.
Vapor may travel considerable distance to source of ignition and flash back.
Hydrogen can burn with an invisible flame.
Harmful or fatal if swallowed - can enter lungs and cause damage.
Breathing high concentrations can cause irregular heartbeats which may be fatal.
Suspect cancer hazard.
Repeated or excessive exposure to certain components of this mixture have been associated with central nervous system effects.
Harmful to aquatic organisms.

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	637 Feed to R1 & R2 Reactors	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable.		
Synonyms	637 Reactor Feed, 637 Reactor Feed + Hydrogen		

SECTION 2. COMPOSITION (TYPICAL)

This product may be composed, in whole or in part, of any of the following refinery streams:

Light Thermal Cracked Naphtha (Petroleum) [CAS No.: 64741-74-8]
Light Catalytic Cracked Naphtha [CAS No.: 64741-55-5]

This product contains the following chemicals as components of the refinery streams listed above:

Component Name(s)	CAS Registry No.	Concentration (%)
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637 Feed to R1 & R2 Reactors

Hexane, other isomers	Mixture	5.7 - 17.8
C6-C9 alpha-Alkenes	68526-99-8	4.72 - 14.65
n-Hexane	110-54-3	1.91 - 11.75
Cyclohexane	110-82-7	1 - 5
Benzene	71-43-2	1 - 4.86
Hydrocarbons, C5-Rich	68476-55-1	2.1 - 3.5
Toluene	108-88-3	0.93 - 4.65
Butenes or Butylenes	25167-67-3	0.93 - 4.65
Xylene, all isomers	1330-20-7	0.93 - 4.51
Octanes, all isomers	Mixture	0.93 - 4.51
Hydrogen	1333-74-0	2
1, 3-Butadiene	106-99-0	<1
Trimethylbenzenes, all isomers	25551-13-7	0.43 - 1.29
Ethylmethylbenzene, all isomers	25550-14-5	0.43 - 1.29
Methylcyclopentane	96-37-7	0.07 - 1.4
Heptane, all isomers	Mixture	0.35 - 1.05
Butanes	Mixture	0.07 - 1.05
Pentanes, all isomers	Mixture	0.07 - 1.05
Ethylbenzene	100-41-4	0.172 - 0.86
Hydrogen Sulfide	7783-06-4	<0.2

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled. Contains hydrogen sulfide. Inhalation of gas or vapor may cause severe nose, throat, respiratory tract, and lung irritation, respiratory paralysis, and death, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.
Eye Contact	This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.
Skin Contact	May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.
Ingestion	Swallowing this material may be harmful. Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea. This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).
Chronic Health Effects Summary	Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea. Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers. Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor

637 Feed to R1 & R2 Reactors

function and paralysis.

This material, or a component of this material, has been shown to cause cancer in laboratory animals. However it is not likely to represent a human cancer hazard.

See Toxicological Information (Section 11)

Conditions Aggravated by Exposure Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Peripheral Nervous System, Central Nervous System (CNS), Heart (Cardiac)

Target Organs Contains material which may cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, , bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

Carcinogenic Potential **CARCINOGENIC EFFECTS** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified + (Proven.) by OSHA+ (Proven.) by NIOSH [1, 3-Butadiene]. Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [1, 3-Butadiene]. Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals

637 Feed to R1 & R2 Reactors

exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IB flammable liquid.		
Flash Point	Open cup: <-45°C (-49°F).		
Lower Flammable Limit	AP 1 %	Upper Flammable Limit	Not Available
Autoignition Temperature	The lowest known value is 225°C (437°F) (n-Hexane).		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.		
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

637 Feed to R1 & R2 Reactors

SECTION 7. HANDLING AND STORAGE

Handling

This gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment, as necessary, to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Both local exhaust and general room ventilation may be essential in work areas to prevent accumulation of potentially explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. Safety glasses equipped with side shields or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.

637 Feed to R1 & R2 Reactors

- Body Protection** Prevent potential skin contact with cold liquid or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
- Respiratory Protection** Odor is not an adequate warning for potentially hazardous air concentrations. For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
C6-C9 alpha-Alkenes n-Hexane	Not available. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Cyclohexane	ACGIH (United States). TWA: 100 ppm 8 hour(s). OSHA (United States). TWA: 300 ppm 8 hour(s).
Benzene	ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Hydrocarbons, C5-Rich Toluene	Not available. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Butenes or Butylenes Xylene, all isomers	Not available. ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
Octanes, all isomers	ACGIH (United States). TWA: 300 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
1, 3-Butadiene	ACGIH (United States). Notes: "A2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). OSHA (United States). Notes: "Z-2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). Action Level: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).

637 Feed to R1 & R2 Reactors

Trimethylbenzenes, all isomers	ACGIH (United States). TWA: 25 ppm 8 hour(s).
Ethylmethylbenzene, all isomers	Not available.
Methylcyclopentane	Not available.
Heptane, all isomers	ACGIH (United States). TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s). OSHA (United States). TWA: 1000 ppm 8 hour(s).
Butanes	ACGIH (United States). TWA: 800 ppm 8 hour(s).
Ethylbenzene	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
Hydrogen Sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Light Thermal Cracked Naphtha (Petroleum)	Not available.
Light Aliphatic Naphthas, Sour (family)	Not available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Biphasic (gas/liquid)	Color	Amber to dark amber	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	Weighted average: 0.75 (Water = 1)	pH	Not Applicable.	Vapor Density	The highest known value is 3.1 (Air = 1) (Toluene). Weighted average: 2.98 (Air = 1)
Boiling Range	The lowest known value is 69°C (156.2°F) (n-Hexane). Weighted average: 81.05°C (177.9°F)	Melting/Freezing Point			Not available.
Vapor Pressure	The highest known value is 16.5 kPa (124 mm Hg) (at 20°C) (n-Hexane). Weighted average: 8.4 kPa (63.01 mm Hg) (at 20°C)	Volatility			
Solubility in Water	Very slightly soluble in cold water. (<0.1 % w/w)	Viscosity (cSt @ 40°C)			not available
Flash Point	Open cup: <-45°C (-49°F).				
Additional Properties	No additional information.				

637 Feed to R1 & R2 Reactors

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Benzene

ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
 INHALATION (LC50):
 (VAPOR): Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of

637 Feed to R1 & R2 Reactors

benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

1, 3-Butadiene

ORAL (LD50): Acute: 5480 mg/kg [Rat].

Studies of Workers Exposed to Butadiene:

Studies show evidence that over-exposure may be associated with an increased incidence of cancers of lymphohematopoietic organ systems, including leukemia.

Studies in Laboratory Animals:

Studies indicate that prolonged, repeated exposure to high levels of butadiene can cause

637 Feed to R1 & R2 Reactors

cancer in multiple organs including lymphohematopoietic organ systems. Studies indicate that exposure to high levels of butadiene can cause chromosome damage to somatic and germ cells. Some studies also show limited evidence that exposure to butadiene may induce heritable mutations. Studies show evidence of adverse effects on male and female reproductive organs following exposure to high levels of butadiene. Embryotoxicity has been reported. Effects included increased rates of fetal death and skeletal variations.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD50), Acute: 3,500 mg/kg [Rat].

DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Hydrogen Sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse].

Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations at or above 100 ppm are immediately dangerous to life and health.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	No data.
Environmental Fate	This product will normally float on water. Components will evaporate rapidly. This material may be harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. The log Kow value for this product is expected to be in the range of 3.3 to 6.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

637 Feed to R1 & R2 Reactors

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: n-Hexane [CAS No.: 110-54-3] Concentration: 6.8% Cyclohexane [CAS No.: 110-82-7] Concentration: 3% Benzene [CAS No.: 71-43-2] Concentration: 2.9% Toluene [CAS No.: 108-88-3] Concentration: 2.8% Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 2.7% Ethylbenzene [CAS No.: 100-41-4] Concentration: 0.5%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: n-Hexane [CAS No.: 110-54-3] RQ = 5000 lb. (2268 kg) Concentration: 6.8% Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lb. (453.6 kg) Concentration: 3% Benzene [CAS No.: 71-43-2] RQ = 10 lb. (4.536 kg) Concentration: 2.9% Toluene [CAS No.: 108-88-3] RQ = 1000 lb. (453.6 kg) Concentration: 2.8% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lb. (45.36 kg) Concentration: 2.7% Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lb. (453.6 kg) Concentration: 0.516% Hydrogen Sulfide [CAS No.: 7783-06-4] RQ = 100 lb. (45.36 kg) Concentration: 0.18%

637 Feed to R1 & R2 Reactors

Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Benzene: 2.93% Toluene: 2.79% 1, 3-Butadiene: 0.9% Ethylbenzene: 0.516%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	2.0
Revision Date	2/25/2005
Print Date	Printed on 2/25/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0048
HFR#240

637 Reactor Effluent

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0048
Revision Date 2/25/2005

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Biphasic (gas/liquid)

Color Amber to dark amber **Odor** Hydrocarbon. Rotten eggs. (Strong.)

DANGER

EXTREMELY FLAMMABLE AND POISONOUS GAS.

Contains hydrogen sulfide gas.

May be fatal if inhaled.

Vapor may travel considerable distance to source of ignition and flash back.

Hydrogen can burn with an invisible flame.

Harmful or fatal if swallowed - can enter lungs and cause damage.

Breathing high concentrations can cause irregular heartbeats which may be fatal.

Suspect cancer hazard.

Repeated or excessive exposure to certain components of this mixture have been associated with central nervous system effects.

Harmful to aquatic organisms.

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	637 Reactor Effluent	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable.		
Synonyms	ScanFiner Reactor Effluent, 637 R2 Reactor Effluent		

SECTION 2. COMPOSITION (TYPICAL)

This product may be composed, in whole or in part, of any of the following refinery streams:

Light Thermal Cracked Naphtha (Petroleum) [CAS No.: 64741-74-8]

Light Catalytic Cracked Naphtha [CAS No.: 64741-55-5]

This product contains the following chemicals as components of the refinery streams listed above:

Component Name(s)	CAS Registry No.	Concentration (%)
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637 Reactor Effluent

Hexane, other isomers	Mixture	5.7 - 17.8
C6-C9 alpha-Alkenes	68526-99-8	4.72 - 14.65
n-Hexane	110-54-3	1.91 - 11.75
Cyclohexane	110-82-7	1 - 5
Benzene	71-43-2	1 - 4.86
Hydrocarbons, C5-Rich	68476-55-1	2.1 - 3.5
Toluene	108-88-3	0.93 - 4.65
Butenes or Butylenes	25167-67-3	0.93 - 4.65
Xylene, all isomers	1330-20-7	0.93 - 4.51
Octanes, all isomers	Mixture	0.93 - 4.51
Hydrogen	1333-74-0	2
1, 3-Butadiene	106-99-0	<1
Trimethylbenzenes, all isomers	25551-13-7	0.43 - 1.29
Ethylmethylbenzene, all isomers	25550-14-5	0.43 - 1.29
Methylcyclopentane	96-37-7	0.07 - 1.4
Heptane, all isomers	142-82-5	0.35 - 1.05
Butanes	Mixture	0.07 - 1.05
Pentanes, all isomers	Mixture	0.07 - 1.05
Ethylbenzene	100-41-4	0.172 - 0.86
Hydrogen Sulfide	7783-06-4	0.3 - 0.5

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled. Contains hydrogen sulfide. Inhalation of gas or vapor may cause severe nose, throat, respiratory tract, and lung irritation, respiratory paralysis, and death, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath.</p> <p>Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness.</p> <p>Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.</p>
Eye Contact	<p>This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.</p>
Skin Contact	<p>May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact.</p> <p>Skin contact may cause harmful effects in other parts of the body.</p>
Ingestion	<p>Swallowing this material may be harmful.</p> <p>Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea.</p> <p>This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death.</p> <p>Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).</p>
Chronic Health Effects Summary	<p>Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea.</p> <p>Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers.</p> <p>Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor</p>

637 Reactor Effluent

function and paralysis.

This material, or a component of this material, has been shown to cause cancer in laboratory animals. However it is not likely to represent a human cancer hazard.

See Toxicological Information (Section 11)

Conditions Aggravated by Exposure Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Peripheral Nervous System, Central Nervous System (CNS), Heart (Cardiac)

Target Organs Contains material which may cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, , bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

Carcinogenic Potential **CARCINOGENIC EFFECTS** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified + (Proven.) by OSHA+ (Proven.) by NIOSH [1, 3-Butadiene]. Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [1, 3-Butadiene]. Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals

637 Reactor Effluent

exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IB flammable liquid.		
Flash Point	Open cup: <-45°C (-49°F).		
Lower Flammable Limit	AP 1 %	Upper Flammable Limit	Not Available
Autoignition Temperature	The lowest known value is 225°C (437°F) (n-Hexane).		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.		
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

637 Reactor Effluent

SECTION 7. HANDLING AND STORAGE

Handling

This gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment, as necessary, to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Both local exhaust and general room ventilation may be essential in work areas to prevent accumulation of potentially explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. Safety glasses equipped with side shields or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.

637 Reactor Effluent

- Body Protection** Prevent potential skin contact with cold liquid or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
- Respiratory Protection** Odor is not an adequate warning for potentially hazardous air concentrations. For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
C6-C9 alpha-Alkenes n-Hexane	Not available. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Cyclohexane	ACGIH (United States). TWA: 100 ppm 8 hour(s). OSHA (United States). TWA: 300 ppm 8 hour(s).
Benzene	ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Hydrocarbons, C5-Rich Toluene	Not available. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Butenes or Butylenes Xylene, all isomers	Not available. ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
Octanes, all isomers	ACGIH (United States). TWA: 300 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
1, 3-Butadiene	ACGIH (United States). Notes: "A2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). OSHA (United States). Notes: "Z-2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). Action Level: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).

637 Reactor Effluent

Trimethylbenzenes, all isomers	ACGIH (United States). TWA: 25 ppm 8 hour(s).
Ethylmethylbenzene, all isomers	Not available.
Methylcyclopentane	Not available.
Heptane, all isomers	ACGIH (United States). TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s). OSHA (United States). TWA: 500 ppm 8 hour(s). ACGIH (United States). TWA: 600 ppm 8 hour(s). OSHA (United States). TWA: 1000 ppm 8 hour(s).
Pentanes, all isomers	ACGIH (United States). TWA: 800 ppm 8 hour(s). ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
Butanes	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Ethylbenzene	Not available.
Hydrogen Sulfide	Not available.
Light Thermal Cracked Naphtha (Petroleum)	Not available.
Light Aliphatic Naphthas, Sour (family)	Not available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Biphasic (gas/liquid)	Color	Amber to dark amber	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	Weighted average: 0.75 (Water = 1)	pH	Not Applicable.	Vapor Density	The highest known value is 3.1 (Air = 1) (Toluene). Weighted average: 2.98 (Air = 1)
Boiling Range	The lowest known value is 69°C (156.2°F) (n-Hexane). Weighted average: 81.05°C (177.9°F)	Melting/Freezing Point			Not available.
Vapor Pressure	The highest known value is 16.5 kPa (124 mm Hg) (at 20°C) (n-Hexane). Weighted average: 8.4 kPa (63.01 mm Hg) (at 20°C)	Volatility			
Solubility in Water	Very slightly soluble in cold water. (<0.1 % w/w)	Viscosity (cSt @ 40°C)			not available
Flash Point	Open cup: <-45°C (-49°F).				
Additional Properties	No additional information.				

637 Reactor Effluent

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Benzene

ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
 INHALATION (LC50):
 (VAPOR): Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of

637 Reactor Effluent

benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

1, 3-Butadiene

ORAL (LD50): Acute: 5480 mg/kg [Rat].

Studies of Workers Exposed to Butadiene:

Studies show evidence that over-exposure may be associated with an increased incidence of cancers of lymphohematopoietic organ systems, including leukemia.

Studies in Laboratory Animals:

Studies indicate that prolonged, repeated exposure to high levels of butadiene can cause

637 Reactor Effluent

cancer in multiple organs including lymphohematopoietic organ systems.

Studies indicate that exposure to high levels of butadiene can cause chromosome damage to somatic and germ cells. Some studies also show limited evidence that exposure to butadiene may induce heritable mutations.

Studies show evidence of adverse effects on male and female reproductive organs following exposure to high levels of butadiene. Embryotoxicity has been reported. Effects included increased rates of fetal death and skeletal variations.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD50), Acute: 3,500 mg/kg [Rat].

DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Hydrogen Sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse].

Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations at or above 100 ppm are immediately dangerous to life and health.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

No data.

Environmental Fate

This product will normally float on water. Components will evaporate rapidly. This material may be harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. The log Kow value for this product is expected to be in the range of 3.3 to 6.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

637 Reactor Effluent

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: n-Hexane [CAS No.: 110-54-3] Concentration: 6.8% Cyclohexane [CAS No.: 110-82-7] Concentration: 3% Benzene [CAS No.: 71-43-2] Concentration: 2.9% Toluene [CAS No.: 108-88-3] Concentration: 2.8% Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 2.7% Ethylbenzene [CAS No.: 100-41-4] Concentration: 0.5%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: n-Hexane [CAS No.: 110-54-3] RQ = 5000 lb. (2268 kg) Concentration: 6.8% Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lb. (453.6 kg) Concentration: 3% Benzene [CAS No.: 71-43-2] RQ = 10 lb. (4.536 kg) Concentration: 2.9% Toluene [CAS No.: 108-88-3] RQ = 1000 lb. (453.6 kg) Concentration: 2.8% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lb. (45.36 kg) Concentration: 2.7% Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lb. (453.6 kg) Concentration: 0.516% Hydrogen Sulfide [CAS No.: 7783-06-4] RQ = 100 lb. (45.36 kg) Concentration: 0.18%

637 Reactor Effluent**Clean Water Act (CWA)**

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Benzene: 2.93%

Toluene: 2.79%

1, 3-Butadiene: 0.9%

Ethylbenzene: 0.516%

New Jersey Right-to-Know Label

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

Additional Regulatory Remarks

No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0

Revision Date 2/25/2005

Print Date Printed on 2/25/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist:				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

HF#240
 GP Lab
 750 Coker
 737 Coker
 Hazchem 3
 Claren
 Barbara
 Melinda
 Maint. 2
 Medical
 M.I.



Thermocracked Tail Gases (C1-C5 Hydrocarbons) Material Safety Data Sheet

LYONDELL-CITGO Refining LP
 12000 Lawndale Avenue
 P.O. Box 2451
 Houston, TX 77252-2451

MSDS No. RS0051
 Revision Date 06/27/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquefied Gas
Color Colorless liquid; invisible gas and vapor; white frost at release point. **Odor** Faint, unpleasant.

DANGER! High pressure and rapid diffusion hazard!
 Extremely flammable gas/liquid; vapor may cause flash fire or explosion!
 High vapor concentrations reduce oxygen available for breathing!
 May cause central nervous system (CNS) depression or suffocation!
 Liquid or compressed gas contact may cause frostbite or freeze burns!
 Vapor or mist may irritate mucous membranes and respiratory tract!
 Liquid contact may cause mild to moderate eye and/or skin irritation!
 May be harmful or fatal if inhaled or absorbed through the skin!
 Overexposures may cause target organ effects such as lung, brain, liver, and/or kidney damage!
 Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!

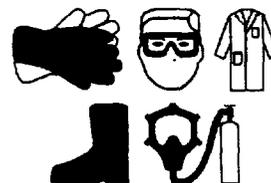
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
 See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Thermocracked Tail Gases (C1-C5 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	071808305*	Medical Emergency	(918) 495-4700
CAS Number	71808-30-5 or 68476-85-7	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)		
Synonyms	Delayed Coker Unit Tail Gases; C1-C5 Alkane, Isoparaffin, and Alkene Hydrocarbons Mixture; Thermal Cracker Absorber Tail Gas (Petroleum); Thermocracker Fractionation Stabilizer Tail Gas (Petroleum); Thermocracker Fractionation Reflux Drum Tail Gas (Petroleum).		

Thermocracked Tail Gases (C1-C5 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Coker Tail Gases (Petroleum)	71808-30-5	100
2) Liquefied Petroleum Gases	68476-85-7	100
3) Methane	74-82-8	1-10
4) Ethane	74-84-0	5-15
5) Ethylene	74-85-1	1-10
6) Propane	74-98-6	10-30
7) Propylene	115-07-1	5-15
8) Isobutane	75-28-5	10-20
9) Butenes or Butylenes	25167-67-3	5-15
10) n-Butane	106-97-8	10-40
11) Iso-Pentane	78-78-4	1-15
12) Pentenes or Pentylenes	68527-11-7	0.5-1.5
13) n-Pentane	109-66-0	1-10

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact. Eye contact.

Signs and Symptoms of Acute Exposure

Inhalation	At least one component of this gas/liquid mixture is a "simple asphyxiant" (see Section 8). High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Breathing vapors may also cause central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure.
Eye Contact	Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Prolonged or repeated vapor exposure may cause irritation. This is based upon animal test results for this product's heavier components.
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. The liquid form may cause mild to moderate skin irritation and inflammation.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus or be aspirated into the lungs. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Chronic inhalation to components of this liquefied gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.
Target Organs	This substance is toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, and possibly, the liver and/or kidneys.
Carcinogenic Potential	This material does not contain any components at concentrations at or above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP.

Thermocracked Tail Gases (C1-C5 Hydrocarbons)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).									
OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines and other sympathomimetic drugs such as epinephrine (adrenaline) should be reserved for emergency situations and then used only with special precaution.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point Method	CLOSED CUP: < -60°C (-76°F). (Estimated)		
Lower Flammable Limit	AP 1.4%	Upper Flammable Limit	AP 12.5%
Autoignition Temperature	AP 288°C (550°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, and unburned hydrocarbon vapors.		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Some components are lighter than air and rise rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, this material will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources!		

Thermocracked Tail Gases (C1-C5 Hydrocarbons)

Extinguishing Media

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.

Protection of Fire Fighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

This liquefied gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Thermocracked Tail Gases (C1-C5 Hydrocarbons)

Storage Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid, solid, or vapors.

Body Protection Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments For an explanation about some of the occupational exposure limits shown below, refer to the definition of "Simple Asphyxiant" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents handbook. Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Thermocracked Tail Gases (C1-C5 Hydrocarbons)

Substance	Applicable Workplace Exposure Levels
1) Methane	Simple asphyxiant.
2) Ethane	Simple asphyxiant.
3) Ethylene	Simple asphyxiant.
4) Propylene	Simple asphyxiant.
5) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
6) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
7) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL)
8) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Faint, unpleasant.
Specific Gravity	0.40 to 0.53 (Water = 1)	pH	Not applicable.	Vapor Density	0.5 to 1.0 (Air = 1)
Boiling Point/Range	-253° to 36°C (-423° to 97°F) at 14.7 psia [ASTM D-2887]			Melting/Freezing Point	-260° to -129°C (-435° to -200°F) at 14.7 psia
Vapor Pressure	100 to 205 psia at 40°C (104°F)			Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Slightly soluble in cold water.			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.

Additional Properties This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard.
Gross Heat of Combustion at 60°F = AP 22,000 to 25,000 Btu/lb or 1,000 to 2,000 Btu/cu.ft.;
Dry Point Temperature = AP 82°F (28°C) [ASTM D-86];
Average Density at 60°F = < 5.0 lbs./gal. [ASTM D-2161].

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Propylene: GAS (LC₅₀): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse]. GAS (TC₁₀): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.</p> <p>Iso-Butane: GAS (TC₁₀): Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement. GAS (LC₅₀): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p> <p>Iso-Butene (Isobutylene or 2-Methylpropene): GAS (LC₅₀): Acute: 415 gm/m³ for 2 hours [Mouse]. GAS (LC₅₀): Acute: 620 gm/m³ for 4 hours [Rat].</p>
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Thermocracked Tail Gases (C1-C5 Hydrocarbons)

n-Butane:

GAS (LC₅₀): Acute: 658,000 mg/m³ for 4 hours [Rat]

GAS (LC₅₀): Acute: 680,000 mg/m³ for 2 hours [Mouse].

n-Pentane:

GAS (LC₅₀): Acute: 364,000 mg/m³ for 4 hours [Rat] - Excitement.

INTRAVENOUS (LD₅₀): Acute: 446 mg/kg [Mouse].

Exposure to 1,000 ppm of propane for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on liquefied petroleum gas, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

In humans, at concentrations of 6.4% in air or higher, propylene causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to propylene may entail a possible hazard from the formation of a reactive metabolite, propylene oxide, which is a "suspect human carcinogen". However, propylene have not been shown to be carcinogenic in rat studies. For example, propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to propylene oxide which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of isobutane and n-butane for periods of 8 hours daily for 10 days to 14 days, respectively. An n-Butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of butane and butenes (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone. Chronic inhalation of high concentrations of isobutane may cause liver and/or kidney damage.

Inhalation of 500 ppm of isopentane or n-pentane have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of n-pentane for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9 to 12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. n-Pentane caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure. Rat 28-day feeding studies on both isopentane and n-pentane using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the ethylene, propylene, and butene components of this material will readily vaporize and may contribute to generation of atmospheric smog.

Environmental Fate

The atmospheric half-lives of ethane, ethylene, propane, propylene, and butenes under photochemical smog conditions are estimated to be between 5 to 8 hours. Experimental data shows that significant photooxidation of ethylene, propylene and butenes occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the butanes under photochemical smog conditions are estimated to be between 5 and 7 days. The pentanes have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of propane, isobutane, and n-butane in air (< 8%) are not considered to be environmentally significant.

Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (< 0.1%); and therefore, this material will not cause harm to aquatic life.

Thermocracked Tail Gases (C1-C5 Hydrocarbons)

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Compressed gases, flammable, n.o.s. (Butanes, Propane)		
Hazard Class	DOT Class: 2.1 (Flammable gas).	Packing Group(s)	Not applicable.
		UN/NA ID	UN1954
Reportable Quantity	The Reportable Quantity (RQ) substance component that might be present in this product which requires DOT HAZMAT bill-of-lading display is n-Hexane		
Picards	Emergency Response Guide No. 115		
		HAZMAT STCC No.	49 057 29
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.



SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. There are no chemical substances present in this material subject to this statute.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which are at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: Ethylene or Ethene [CAS No. 74-85-1] concentration: 1 to 10% Propylene or Propene [CAS No. 115-07-1] concentration: 5 to 15%.

Thermocracked Tail Gases (C1-C5 Hydrocarbons)

CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This material does not contain any chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": Ethylene (Ethene), Propylene (Propene), 1-Butene, Isobutylene, 1-Pentane, and n-Pentane. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: Methane, Ethane, Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), Butane, various Butenes, Isopentane (Butane, 2-methyl), various Pentenes, and n-Pentane.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 06/27/2002
Print Date Printed on 06/27/2002.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT

***** END OF MSDS *****



Reformate Gases (C2-C6 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0052
Revision Date 05/28/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquefied Gas		
Color	Colorless liquid, invisible vapor.	Odor	Faint, unpleasant.

DANGER! Extremely flammable compressed gas/liquid;
vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
High concentrations of vapor reduce oxygen available for breathing and
may cause central nervous system depression or suffocation!
Pressurized gas contact may cause frostbite or freeze burns!
May be harmful or fatal if inhaled or absorbed through the skin!
Vapor or mist may irritate mucous membranes and respiratory tract!
Liquid contact may cause mild to moderate eye and/or skin irritation!
Overexposures may cause target organ effects such as lung, brain,
liver, kidney, and/or peripheral nervous system damage!
Prolonged and/or repeated inhalation may increase the
heart's susceptibility to arrhythmias (irregular beats)!

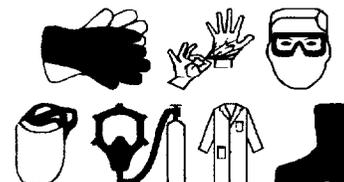
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Reformate Gases (C2-C6 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068513633*	Medical Emergency	(918) 495-4700
CAS Number	68513-63-3, 68476-47-1, 68478-15-9, and/or 68921-09-5.	CHEMTREC Emergency	(800) 424-9300
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)		
Synonyms	C2-C6 Catalytic Reformer Hydrocarbons; C2-C6 Alkane and Isoparaffin Hydrocarbons Mixture; Catalytic Reformed Straight-run Distillate (Petroleum); Platformer Product Separator Off Gas (Petroleum); Naphtha Cat Reformer Stabilizer Overhead Stream (Petroleum), Naphtha Unifiner Stripper Distillate (Petroleum).		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Catalytic Reformed Straight-run Distillate (Petroleum)	68513-63-3	100
2) Catalytic Reformer C2-C6 Hydrocarbons	68476-47-1	100
3) Liquefied Petroleum Gases	68476-85-7	100
4) Ethane	74-84-0	5-20
5) Propane	74-98-6	10-30
6) Iso-Butane	75-28-5	10-20
7) n-Butane	106-97-8	20-40
8) Iso-Pentane	78-78-4	1-10
9) n-Pentane	109-66-0	5-15
10) Hexane Isomers	Mixture	1-5
11) n-Hexane	110-54-3	0-3

**Reformate Gases
(C2-C6 Hydrocarbons)**

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact Eye contact

Signs and Symptoms of Acute Exposure

Inhalation	At least one component of this gas/liquid mixture is a "simple asphyxiant" (see Section 8). High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Breathing vapors may also cause central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure
Eye Contact	Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Prolonged or repeated vapor exposure may cause irritation. This is based upon animal test results for this product's heavier components.
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. The liquid form may cause mild to moderate skin irritation and inflammation. The n-hexane component of this material may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above) and/or peripheral nerve damage. If the skin is damaged, absorption increases.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus or be aspirated into the lungs. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death
Chronic Health Effects Summary	Chronic inhalation to components of this liquefied gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline) -like drugs. Even with acute exposures, the n-hexane component is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, nervous system disease, psychological conditions, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.
Target Organs	The substance is toxic to eyes, skin, mucous membranes, lungs, central and peripheral nervous systems, brain, heart, and possibly, the liver, kidneys, and reproductive systems
Carcinogenic Potential	This product does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Reformate Gases (C2-C6 Hydrocarbons)

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines and other sympathomimetic drugs such as epinephrine (adrenaline) should be reserved for emergency situations and then used only with special precaution.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point/Method	CLOSED CUP. LT -60°C (-76°F). (Estimated)		
Lower Flammable Limit	AP 1.4%	Upper Flammable Limit	AP 12.5%
Auto-Ignition Temp.	AP 288°C (550°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, and unburned hydrocarbon vapors		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

Reformate Gases (C2-C6 Hydrocarbons)

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability. Odor is not an adequate warning of hazardous air concentrations.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

Reformate Gases (C2-C6 Hydrocarbons)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid, solid, or vapors.

Body Protection Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
2) Ethane	Simple asphyxiant.
3) Propane	TWA: 2500 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
4) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1998] TWA: 800 (ppm) from OSHA (PEL) [1989]
5) Pentanes	TWA: 600 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1976]
6) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1989]
7) n-Hexane	TWA: 50 (ppm) from ACGIH (TLV) [1998] - SKIN TWA: 500 (ppm) from OSHA (PEL) [1976]

Reformate Gases (C2-C6 Hydrocarbons)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible vapor.	Odor	Faint, unpleasant.
Specific Gravity	AP 0.38 to 0.68 (Water = 1)	pH	Not applicable.	Vapor Density	AP 1.0 to 3.0 (Air = 1)
Boiling Point/Range	AP -88° to 69°C (-127° to 156°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			AP -188° to -95°C (-305° to -139°F) at 14.7 psia
Vapor Pressure	AP 15 to 190 psia at 40°C (104°F)	Viscosity (cSt @ 40°C)			Not applicable.
Solubility in Water	Slightly soluble in cold water.	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 20,750 to 21,500 Btu/lb or 2,500 to 4,000 Btu/cu.ft., Dry Point Temperature = AP 146°F (63°C) (ASTM D-86), Average Density at 60°F = AP 5.0 lbs./gal. (ASTM D-2161).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur, but possible
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Iso-Butane:

GAS (TCLo) Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement.

GAS (LC50). Acute 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

n-Butane:

GAS (LC50) Acute 658,000 mg/m³ for 4 hours [Rat].

GAS (LC50): Acute 680,000 mg/m³ for 2 hours [Mouse].

n-Pentane:

GAS (LC50): Acute: 364,000 mg/m³ for 4 hours [Rat] - Excitement.

INTRAVENOUS (LD50): Acute. 446 mg/kg [Mouse]

n-Hexane:

GAS (LC50): Acute: 48,000 ppm for 4 hours [Rat].

ORAL (LD50): Acute: 28,710 mg/kg [Rat].

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane and n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

Reformate Gases (C2-C6 Hydrocarbons)

Inhalation of 500 ppm of **isopentane** or **n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9 to 12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. **n-Pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure. Rat 28-day feeding studies on both isopentane and **n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic.

Intentional sniffing abuse of **n-hexane** has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to **n-hexane**, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (polyneuropathy). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of **n-hexane** may be increased by concurrent exposure to **methyl ethyl ketone, methyl isobutyl ketone, and/or toluene**.

n-Hexane is NOT a tumor promotor in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. **n-Hexane**, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity Ecological effects testing has not been conducted on this material. However, **refined liquefied petroleum hydrocarbon gases** are only slightly soluble in water (LT 0.1%); and therefore, this material is not expected to cause harm to aquatic life.

Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, this material will readily vaporize and may contribute to generation of atmospheric smog.

Environmental Fate The atmospheric half-life of **propane** under photochemical smog conditions is estimated to be between 5 to 8 hours. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. **Pentanes and hexanes** have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of **propane, isobutane, and n-butane** in air (LT 8%) is not considered to be environmentally significant.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Reformate Gases
(C2-C6 Hydrocarbons)**

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Petroleum gases, liquefied		
Hazard Class	CLASS 2.1. Flammable gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1075
Reportable Quantity	The Reportable Quantity (RQ) substance component that might be present in this product which requires DOT HAZMAT bill-of-lading display is n-Hexane .		
Placards		Emergency Response Guide No.	115
		HAZMAT STCC No.	49 057 68
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. There are no chemical substances present in this material subject to this statute.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following component in concentrations which might be at or above de minimis levels and is listed as a toxic chemical in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA. n-Hexane [CAS No. 110-54-3] concentration: 0 to 3%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance that might be present in this material which are subject to this statute is: n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 0 to 3%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component in this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare": n-Pentane .

**Reformate Gases
(C2-C6 Hydrocarbons)**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Ethane, Propane, Isobutane (Propane, 2-methyl), Butane, Isopentane (Butane, 2-methyl), and n-Pentane.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2 0
Revision Date 05/28/1999
Print Date Printed on 07/26/1999

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Pentanes-Rich Petroleum Ether (C4-C6 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0053
Revision Date 05/31/2000

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquefied Gas/Liquid
Color Transparent, colorless liquid; invisible vapor
Odor Light hydrocarbons.

DANGER! Extremely flammable compressed gas/liquid;
vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
High concentrations of vapor reduce oxygen available for breathing and
may cause central nervous system depression or suffocation!
Prolonged and/or repeated inhalation may increase the
heart's susceptibility to arrhythmias (irregular beats)!
Pressurized gas contact may cause frostbite or freeze burns!
May be harmful or fatal if inhaled or absorbed through the skin!
Vapor or mist may irritate mucous membranes and respiratory tract!
Liquid contact may cause mild to moderate eye and/or skin irritation!
Overexposures may cause target organ effects such as brain and/or
peripheral nervous system damage!
Based upon animal testing, may adversely affect reproduction!

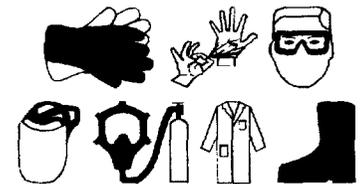
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Pentanes-Rich Petroleum Ether (C4-C6 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068476437*	Medical Emergency	(918) 495-4700
CAS Number	68476-43-7 and 64741-87-3	CHEMTREC Emergency	(800) 424-9300
Product Family	Liquefied Petroleum Ether		
Synonyms	Petroleum Ether, Petroleum Benzin; C5 Concentrate, C5 Sweetened Petroleum Ether; C4-C6 Hydrocarbons, C5-Rich; C4-C6 Alkane, Isoparaffin, and Alkene Hydrocarbons Mixture		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) C4-C6, C5-Rich, Hydrocarbons	68476-43-7	100
2) Sweetened Naphtha	64741-87-3	100
3) Iso-Butane	75-28-5	1-10
4) Butenes or Butylenes	25167-67-3	0 5-5
5) n-Butane	106-97-8	5-25
6) Iso-Pentane	78-78-4	25-45
7) Neo-Pentane	463-82-1	1-5
8) Pentenes or Pentylenes	68527-11-7	1-5
9) Cyclopentane	287-92-3	1-5
10) n-Pentane	109-66-0	25-50
11) Hexane Isomers	Mixture	1-15
12) Cyclohexane	110-82-7	0.5-3
13) n-Hexane	110-54-3	0 5-5

**Pentanes-Rich Petroleum Ether
(C4-C6 Hydrocarbons)**

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact Eye contact

Signs and Symptoms of Acute Exposure

Inhalation	Components of this liquefied gas/naphtha may produce mild narcotic effects. High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Breathing vapors may also cause upper respiratory tract irritation and/or central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure. Approximately 20,000 ppm (or 2 vol.%) of the vapor in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes.
Eye Contact	Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Prolonged or repeated vapor exposure may cause irritation. This is based upon animal test results for this product's heavier components.
Skin Contact	Direct contact with a liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. The liquid form may cause mild to moderate skin irritation and inflammation. The n-hexane component of this material may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above) and/or peripheral nerve damage. If the skin is damaged, absorption increases.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus or be aspirated into the lungs. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Chronic inhalation to components of this liquefied gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline) -like drugs. Even with acute exposures, n-hexane is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, 2,5-hexanedione , has been shown to cause degeneration of the testes. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, nervous system disease, psychological conditions, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure. Exposure to high concentrations of this material may increase the sensitivity of the heart to epinephrine (adrenalin) and catecholamine-like drugs . Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").
Target Organs	The substance is toxic to eyes, skin, mucous membranes, lungs, central and peripheral nervous systems, brain, heart, and possibly, the liver, kidneys, and reproductive systems.
Carcinogenic Potential	This product does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification			OSHA Physical Hazard Classification						
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

**Pentanes-Rich Petroleum Ether
(C4-C6 Hydrocarbons)**

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable!		
Flash Point Method	CLOSED CUP: -60° to -40°C (-76° to -40°F) (Estimated)		
Lower Flammable Limit	AP 1.1%	Upper Flammable Limit	AP 10.0%
Autoignition Temperature	232° to 288°C (450° to 550°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, unburned hydrocarbons, and possibly other harmful gases/vapors.		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		

**Pentanes-Rich Petroleum Ether
(C4-C6 Hydrocarbons)**

**Fire Fighting Protective
Clothing**

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas/Naphtha! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors

Caution: Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of its vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802)

SECTION 7: HANDLING AND STORAGE

Handling

Odor is an inadequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Do not allow vaporizing material to contact eyes, skin, or other tissues. Never siphon by mouth. Prevent contact with food, chewing, or smoking materials. Do not take internally

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits and wear personal protective clothing as shown in Section 8. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Pentanes-Rich Petroleum Ether (C4-C6 Hydrocarbons)

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and well sealed. All label warnings and precautions must be observed. Return empty containers to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Pentanes-Rich Petroleum Ether (C4-C6 Hydrocarbons)

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1999] TWA: 1000 (ppm) from OSHA (PEL) [1989]
2) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
3) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1999] TWA: 800 (ppm) from OSHA (PEL) [1989]
4) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) [1999] TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [1989] TWA: 1000 (ppm) from OSHA (PEL) [1976]
5) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) [1999] TWA: 600 (ppm) from OSHA (PEL) [1989]
6) Hexane, other isomers	TWA: 500 STEL 1000 (ppm) from ACGIH (TLV) [1999] TWA: 500 (ppm) from OSHA (PEL) [1989]
7) Cyclohexane	TWA: 300 (ppm) from ACGIH (TLV) [1999] TWA: 200 STEL: 400 (ppm) from ACGIH (TLV) [Proposed for 2000] TWA: 300 (ppm) from OSHA (PEL) [1976]
8) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 50 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas/Liquid	Color	Transparent, colorless liquid; invisible vapor	Odor	Light hydrocarbons
Specific Gravity	0.60 to 0.64 (Water = 1)	pH	Not applicable.	Vapor Density	2.4 to 2.6 (Air = 1)
Boiling Point/Range	AP -12° to 69°C (11° to 156°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			-160° to -95°C (-255° to -139°F) at 14.7 psia
Vapor Pressure	15 to 30 psia at 40°C (104°F) or GT 140 mm of Hg at 20°C (68°F).	Viscosity (cSt @ 40°C)			LT 1
Solubility in Water	Slightly soluble in cold water (AP 0.1%).	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = 20,750 to 21,100 Btu/lb or 3,250 to 4,750 Btu/cu ft.; Dry Point Temperature = AP 150°F (66°C) (ASTM D-86), Average Density at 60°F = AP 5.15 pounds/gallon (ASTM D-2161)				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur, but possible.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS		

**Pentanes-Rich Petroleum Ether
(C4-C6 Hydrocarbons)**

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Iso-Butane

GAS (TCLo): Acute 1,040 gm/m³ for 2 hours [Mouse] - Excitement

GAS (LC50). Acute 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress

n-Butane:

GAS (LC50): Acute: 658,000 mg/m³ for 4 hours [Rat].

GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse]

2,2-Dimethylpropane (Neopentane)

INTRAPERITONEAL (LD50) Acute 100 mg/kg [Mouse].

n-Pentane

GAS (LC50): Acute 364 gm/m³ for 4 hour(s) [Rat] - Excitement

INTRAVENOUS (LD50) Acute. 446 mg/kg [Mouse].

Cyclohexane.

GAS (LC50) Acute: 22,500 ppm for 4 hours [Rabbit].

ORAL (LD50). Acute: 12,705 mg/kg [Rat].

ORAL (LD50) Acute: 813 to 1,300 mg/kg [Mouse].

ORAL (LD50): Acute GT 180,000 mg/kg [Rabbit].- Severe diarrhea, vascular damage and collapse, hepatocellular degeneration, and glomerulonephritis

n-Hexane

GAS (LC50): Acute: 48,000 ppm for 4 hours [Rat].

ORAL (LD50) Acute: 28,710 mg/kg [Rat].

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane and n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9 to 12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be be fatal. n-Pentane caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure. Rat 28-day feeding studies on both isopentane and n-pentane using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic

Cyclohexane is a minimal to moderate eye, skin, and mucous membrane irritant, CNS depressant, and causes narcosis at high concentrations in air. There is a narrow margin between narcosis, loss of reflexes, and death. In experimental animals exposed to lethal concentrations by inhalation or oral route, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys, and brain. Cyclohexane does not act as a promotor for tumors on mice when exposed to dimethylbenzanthracene; and, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation; however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Intentional sniffing abuse of **n-hexane** has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to n-hexane, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (polyneuropathy). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane may be increased by concurrent exposure to **methyl ethyl ketone, methyl isobutyl ketone, and/or toluene**.

Pentanes-Rich Petroleum Ether (C4-C6 Hydrocarbons)

n-Hexane is NOT a tumor promotor in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. **n-Hexane**, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats, but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	<p>Ecological effects testing has not been conducted on this material. If spilled, this material, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Liquefied gas/naphtha mixtures will normally evaporate rapidly if spilled.</p> <p>Using Rainbow Trout (<i>Oncorhynchus mykiss</i>) and Dungeness Crab (<i>Cancer magister</i>), similar naphthas showed a 96-hour TLM (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. 24-hour TLMs resulted in 2,990 ppm and 250 ppm when using Bluegill Sunfish (<i>Lepomis macrochirus</i>) and juvenile American Shad (<i>Squalius cephalus</i>), respectively. Also, 24-hour and 96-hour LC50s for cyclohexane produced results from 25 ppm to 60 ppm when using Bluegill Sunfish (<i>Lepomis macrochirus</i>), Goldfish (<i>Carassius auratus</i>), and Guppy (<i>Lebistes reticulatus</i>) in fresh water. Using Mosquito Fish (<i>Gambusia affinis</i>), cyclohexane showed a 24-hour TLM of 15,500 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.</p>
Environmental Fate	<p>Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, this material will readily vaporize and its olefinic hydrocarbon components (butenes and pentenes) may contribute to the creation of atmospheric smog. The atmospheric half-lives of the butanes under photochemical smog conditions are estimated to be between 5 and 7 days. Pentanes and hexanes have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Cyclohexane has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present. Photooxidation of isobutane and n-butane in air (LT 8%) is not considered to be environmentally significant.</p> <p>For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)</p>

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas/naphtha mixture to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum ether		
Hazard Class	DOT CLASS 3: Flammable liquid.	Packing Group(s)	PG I
		UN/NA ID	UN1271
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Cyclohexane and n-Hexane .		

**Pentanes-Rich Petroleum Ether
(C4-C6 Hydrocarbons)**

Placards

Emergency Response Guide No. 128

HAZMAT STCC No.

49 102 27

MARPOL III Status

Not a DOT "Marine Pollutant"
per 49 CFR 171.8.**SECTION 15: REGULATORY INFORMATION**

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. There are no chemical substances present in this material subject to this statute
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Cyclohexane [CAS No. 110-82-7] concentration: 0.5 to 3% n-Hexane [CAS No. 110-54-3] concentration: 0.5 to 5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance that might be present in this material which are subject to this statute is: Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.5 to 3% n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 0.5 to 5%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be not subject to requirements of California Health & Safety Code Section 25249.5
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This material contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of Cyclohexane [CAS No. 110-82-7] , this material might be subject to US EPA's one-time only per country export notification requirements. In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare" 1-Butene [CAS No. 106-98-9], Isobutylene [CAS No. 115-11-7], Isopentane [CAS No. 78-78-4], n-Pentane [CAS No. 109-66-0], and Cyclohexane [CAS No. 110-82-7]

**Pentanes-Rich Petroleum Ether
(C4-C6 Hydrocarbons)**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Isobutane (Propane, 2-methyl), Butane, Isopentane (Butane, 2-methyl), various Butenes and Pentenes, and n-Pentane**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 05/31/2000
Print Date Printed on 06/01/2000

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0054
HFR# 240

Stabilizer Tower Bottoms Stream

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0054
Revision Date 2/25/2005

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Emergency Overview

Physical State Gas/liquid
Color Transparent, colorless.
Odor Hydrocarbon. Rotten eggs. (Strong.)

DANGER:
EXTREMELY FLAMMABLE LIQUID AND VAPOR, VAPOR MAY CAUSE FLASH FIRE.

Vapor may travel considerable distance to source of ignition and flash back.

Harmful or fatal if swallowed - can enter lungs and cause damage.

Breathing high concentrations can cause irregular heartbeats which may be fatal.

May be harmful if inhaled or absorbed through the skin.

Can cause eye, skin or respiratory tract irritation.

Overexposure can cause central nervous system (CNS) depression and/or other target organ effects.

Harmful to aquatic organisms.

Possible Cancer Hazard (See Section 3)

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Stabilizer Tower Bottoms Stream	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	64741-74-8	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable.		
Synonyms	C4-C9 Petroleum Hydrocarbons, Unsweetened Light Hydrotreated Naphtha, Unsweetened Light Solvent Naphtha, Unsweetened C4-C9 Solvent, BRU No 3 and No 11 Stabilizer Tower Bottoms Streams		

SECTION 2. COMPOSITION (TYPICAL)

This product may be composed, in whole or in part, of any of the following refinery streams:

Light Thermal Cracked Naphtha (Petroleum) [CAS No.: 64741-74-8]

This product contains the following chemicals as components of the refinery streams listed above:

Component Name(s)	CAS Registry No.	Concentration (%)
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Stabilizer Tower Bottoms Stream

Hexane, other isomers	Mixture	10 - 50
n-Hexane	110-54-3	10 - 30
Methylcyclopentane	96-37-7	1 - 20
Heptane, all isomers	Mixture	5 - 15
Pentanes, all isomers	Mixture	1 - 15
Butanes	Mixture	1 - 15
C6-C9 alpha-Alkenes	68526-99-8	1 - 10
Toluene	108-88-3	1 - 5
Benzene	71-43-2	1 - 5
Cyclohexane	110-82-7	1 - 5
Xylene, all isomers	1330-20-7	1 - 3
Octanes, all isomers	Mixture	1 - 3
1, 3-Butadiene	106-99-0	<1
Hydrogen Sulfide	7783-06-4	<0.2

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled. Contains hydrogen sulfide. Inhalation of gas or vapor may cause severe nose, throat, respiratory tract, and lung irritation, respiratory paralysis, and death, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.
Eye Contact	This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.
Skin Contact	May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.
Ingestion	Swallowing this material may be harmful. Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea. This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).

Chronic Health Effects Summary	Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea. Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers. Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis. This material, or a component of this material, has been shown to cause cancer in laboratory animals. However it is not likely to represent a human cancer hazard. See Toxicological Information (Section 11)
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Conditions Aggravated by Exposure

Stabilizer Tower Bottoms Stream

Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Peripheral Nervous System, Central Nervous System (CNS), Heart (Cardiac)

Target Organs

Contains material which may cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

Carcinogenic Potential

CARCINOGENIC EFFECTS Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified + (Proven.) by OSHA+ (Proven.) by NIOSH [1, 3-Butadiene]. Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [1, 3-Butadiene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation

Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact

Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact

Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion

Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician

INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

Stabilizer Tower Bottoms Stream

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.		
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)		
Lower Flammable Limit	AP 1 %	Upper Flammable Limit	AP 13 %
Autoignition Temperature	not available		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.		
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid enter sewers or waterways.		

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free

Stabilizer Tower Bottoms Stream

liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Do NOT use compressed air for filling, discharging or other handling operations.

Product container is not designed for elevated pressure. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Do not expose product containers to flames, sparks, heat or other potential ignition sources. Empty containers may contain product residues that can ignite with explosive force. Observe label precautions. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C). All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable regulatory requirements and the National Electrical Code.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex

Stabilizer Tower Bottoms Stream



- Eye Protection** Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.
- Hand Protection** Avoid skin contact. Use heavy duty gloves constructed of chemical resistant materials such as Viton® or heavy nitrile rubber. Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.
- Body Protection** Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
n-Hexane	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Methylcyclopentane Heptane, all isomers	Not available. ACGIH (United States). TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s). OSHA (United States). TWA: 1000 ppm 8 hour(s).
Butanes	ACGIH (United States). TWA: 800 ppm 8 hour(s).
C6-C9 alpha-Alkenes Toluene	Not available. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Benzene	ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s).

Stabilizer Tower Bottoms Stream

Cyclohexane	STEL: 5 ppm 15 minute(s). ACGIH (United States). TWA: 100 ppm 8 hour(s).
Xylene, all isomers	OSHA (United States). TWA: 300 ppm 8 hour(s). ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
Octanes, all isomers	ACGIH (United States). TWA: 300 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
1, 3-Butadiene	ACGIH (United States). Notes: "A2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). OSHA (United States). Notes: "Z-2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). Action Level: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Hydrogen Sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Light Aliphatic Naphthas, Sour (family)	Not available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas/liquid	Color	Transparent, colorless.	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	0.65 (Water = 1)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	-12°C (10.4°F)			Melting/Freezing Point	-160°C (-256°F)
Vapor Pressure	Not applicable.			Volatility	650 g/l VOC (w/v)
Solubility in Water				Viscosity (cSt @ 40°C)	not available
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks and flame.		
Materials Incompatibility	Incompatible with strong acids, strong bases, and strong oxidizers.		

Stabilizer Tower Bottoms Stream

Hazardous Decomposition Products

No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

Heptane, all isomers

n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

Pentanes, all isomers

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Butanes

Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Benzene

ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
INHALATION (LC50):

Stabilizer Tower Bottoms Stream

(VAPOR): Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

1, 3-Butadiene

ORAL (LD50): Acute: 5480 mg/kg [Rat].

Studies of Workers Exposed to Butadiene:

Stabilizer Tower Bottoms Stream

Studies show evidence that over-exposure may be associated with an increased incidence of cancers of lymphohematopoietic organ systems, including leukemia.

Studies in Laboratory Animals:

Studies indicate that prolonged, repeated exposure to high levels of butadiene can cause cancer in multiple organs including lymphohematopoietic organ systems.

Studies indicate that exposure to high levels of butadiene can cause chromosome damage to somatic and germ cells. Some studies also show limited evidence that exposure to butadiene may induce heritable mutations.

Studies show evidence of adverse effects on male and female reproductive organs following exposure to high levels of butadiene. Embryotoxicity has been reported. Effects included increased rates of fetal death and skeletal variations.

Hydrogen Sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse].

Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations at or above 100 ppm are immediately dangerous to life and health.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

No data.

Environmental Fate

This product will normally float on water. Components will evaporate rapidly. This material may be harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. The log Kow value for this product is expected to be in the range of 3.3 to 6.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

Stabilizer Tower Bottoms Stream

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: n-Hexane [CAS No.: 110-54-3] Concentration: 10% Cyclohexane [CAS No.: 110-82-7] Concentration: 3% Benzene [CAS No.: 71-43-2] Concentration: 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: 20% Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: 3% Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: 3% Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lbs. (453.6 kg) Concentration: 3% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 2% Hydrogen Sulfide [CAS No.: 7783-06-4] RQ = 100 lbs. (45.36 kg) Concentration: 0.18%
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Benzene: 2% 1, 3-Butadiene: 0.9%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

Stabilizer Tower Bottoms Stream

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 2/25/2005
Print Date Printed on 2/25/2005.

ABBREVIATIONS

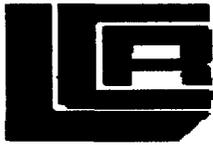
AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist:				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



n-Butane to the Caustic Treaters

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0055
Revision Date 05/24/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquefied Gas		
Color	Colorless liquid; invisible gas and vapor, white frost at release point.	Odor	Strong, unpleasant, and distinctive of skunk or rotten cabbage.

**DANGER! Extremely flammable liquefied gas;
vapor may cause flash fire or explosion!**
May form explosive peroxides on exposure to air!
High pressure and rapid diffusion hazard!
Liquid or compressed gas contact may cause frostbite or freeze burns!
May be harmful or fatal if inhaled or absorbed through the skin!
**High concentrations of vapor reduce oxygen available for breathing and
may cause central nervous system (CNS) depression or suffocation!**
**Vapor or mist may cause mild to severe eye, mucous membrane, and
respiratory tract irritation and inflammation!**
**Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats)!**
**Overexposures may cause target organ effects such as lung, brain,
central nervous system, heart, blood, liver, and/or kidney damage!**
**Contains low levels of 1,3-Butadiene! Based upon laboratory animal
tests, cancer, mutagenic, and reproductive hazards might exist!**
May cause blood system disorders and/or genetic damage!
May adversely affect reproduction or reproductive development!

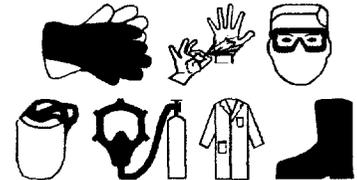
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	n-Butane to the Caustic Treaters	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110055	Medical Emergency	(918) 495-4700
CAS Number	Mixture (See Section 2)	CHEMTREC Emergency	(800) 424-9300
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)		
Synonyms	Untreated Technical-Grade normal-Butane; High-Sulfur, Refinery-grade, n-Butane-rich, Liquefied C4/C5 Gas; Unsweetened Butane LPG; Raw n-Butane; Untreated NC4/IC5 Concentrate LPG or LP-Gas, BRU No 2 Deisobutanizer Tower Bottoms; C4/C5 Olefin/Alkane Hydrocarbons and Mercaptans Mix; Feeds to Merox Unit 1st & 2nd Stage Caustic Settlers and n-Butane Product Settler, NC4-Rich LPG containing Mercaptans; C3-C6 Hydrocarbons and R-SHs		

n-Butane to the Caustic Treaters

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Liquefied Petroleum Gases	68476-85-7	100
2) C3-C6 Hydrocarbons	68513-26-8	98-100
3) n-Butane	106-97-8	65-96
4) Iso-Pentane	78-78-4	1-30
5) Iso-Butane	75-28-5	1-25
6) Butenes or Butylenes	25167-67-3	1-15
7) n-Pentane	109-66-0	1-15
8) Pentenes or Pentylenes	68527-11-7	0-10
9) Isobutylene	115-11-7	0-7
10) 1,3-Butadiene	106-99-0	0.1-6
11) Hexane Isomers	Mixture	0-5
12) Propane	74-98-6	0-1.5
13) Methyl mercaptan	74-93-1	0-0.5
14) Ethyl mercaptan	75-08-1	0-0.5
15) C3 Mercaptans	Mixture	0-0.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin contact. Eye contact. Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 150 ppm or more of methyl mercaptan are immediately dangerous to life and health. At concentrations above 700 ppm, it may cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11)</p> <p>High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces</p>
Eye Contact	Vapors may cause mild to severe eye irritation upon short-term exposure. Severity depends upon the concentration of mercaptans and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with an expanding liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Methyl mercaptan can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus.
Chronic Health Effects Summary	<p>Chronic inhalation to components of this gas (propane, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.</p> <p>1,3-Butadiene (BD), a minor component of this stream, has been shown to be mutagenic and produces multiple organ tumors in various tissues of laboratory rodents. BD also causes sexual organ atrophy in test animals (See Section 11.)</p>
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.
Target Organs	This stream is toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, and possibly, the liver, kidneys, bladder, and/or reproductive systems

n-Butane to the Caustic Treaters

Carcinogenic Potential This stream contains 1,3-butadiene at concentrations at or above 0.1%. 1,3-Butadiene is considered carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Liquefied Gas.		
Flash Point/Method	CLOSED CUP: LT -60° to -51°C (-76° to -60°F) (Estimated)		
Lower Flammable Limit	AP 1.4 %	Upper Flammable Limit	AP 21.8 %
Auto-Ignition Temp.	AP 288°C (550°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans		

n-Butane to the Caustic Treaters

Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling **Danger! Poisonous and Flammable Gas!** Do NOT breathe vapor, it may contain mercaptans. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

n-Butane to the Caustic Treaters

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 and wear appropriate personal protective clothing/equipment. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposures, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against mercaptans.

n-Butane to the Caustic Treaters**Occupational Exposure Guidelines**

Substance	Applicable Workplace Exposure Levels
1) Methyl mercaptan	TWA: 5 (ppm) from ACGIH (TLV) [1997] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998]
2) Ethyl mercaptan	TWA: 0.5 CEIL: 10 (ppm) from OSHA [1989] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998]
3) Liquefied Petroleum Gases	TWA: 0.5 CEIL: 10 (ppm) from OSHA (PEL) [1989] TWA: 1000 (ppm) from ACGIH (TLV) [1998]
4) Propane	TWA: 1000 (ppm) from OSHA (PEL) [1989] TWA: 2500 (ppm) from ACGIH (TLV) [1998]
5) Butanes	TWA: 1000 (ppm) from OSHA (PEL) [1989] TWA: 800 (ppm) from ACGIH (TLV) [1998]
6) 1,3-Butadiene ("A2" and "Z-2" Carcinogen)	TWA: 800 (ppm) from OSHA (PEL) [1989] TWA: 2 (ppm) from ACGIH (TLV) [1998]
7) Pentanes	TWA: 2 STEL: 5 AL: 1 (ppm) from OSHA (PEL) [1994] TWA: 600 (ppm) from ACGIH (TLV) [1998]
8) Hexane, other isomers	TWA: 1000 (ppm) from OSHA (PEL) [1976] TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible gas and vapor; white frost at release point	Odor	Strong, unpleasant, and distinctive of skunk or rotten cabbage
Specific Gravity	AP 0.58 to 0.62 (Water = 1)	pH	Not applicable.	Vapor Density	AP 2.0 to 2.3 (Air = 1)
Boiling Point/Range	AP -42° to 63°C (-43° to 146°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			AP -160° to -99°C (-255° to -147°F) at 14.7 psia
Vapor Pressure	AP 20 to 75 psia at 40°C (104°F)	Viscosity (cSt @ 40°C)			Not applicable.
Solubility in Water	Negligible to slightly soluble in cold water.	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 20,700 to 21,100 Btu/lb or 3,350 Btu/cu.ft.; Dry Point Temperature = AP 121°F (49°C) (ASTM D-86); Average Density at 60°F = 5.0 lbs./gal. (ASTM D-2161)				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur, but possible.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

n-Butane to the Caustic Treaters

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Methanethiol (Methyl mercaptan):

GAS (LC50): Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration
 GAS (LC50): Acute: 6,530 ug/m³ for 2 hours [Mouse].

Ethanethiol (Ethyl mercaptan):

GAS (LC50): Acute: 2,770 ppm for 4 hours [Mouse] - Excitement, motor activity changes, and cyanosis.
 GAS (LC50): Acute: 4,420 ppm for 4 hours [Rat] - Excitement, spastic paraparesis, and cyanosis.
 ORAL (LD50): Acute: 682 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.
 INTRAPERITONEAL (LD50): Acute: 226 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.

1-Propanethiol (n-Propyl mercaptan):

GAS (LC50): Acute: 4,010 ppm for 4 hours [Mouse] - Respiratory stimulation, somnolence, and chromidracryorrhea
 GAS (LC50): Acute: 7,300 ppm for 4 hours [Rat] - Respiratory stimulation, somnolence, and lacrimation
 ORAL (LD50): Acute: 1,790 mg/kg [Rat] - Respiratory depression, somnolence, and coma.
 INTRAPERITONEAL (LD50): Acute: 515 mg/kg [Rat] - Respiratory depression, somnolence, and coma.

Iso-Butane:

GAS (TCLo): Acute: 1,040,000 mg/m³ for 2 hours [Mouse] - Excitement.
 GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

Iso-Butene (Isobutylene or 2-Methylpropene):

GAS (LC50): Acute: 415,000 mg/m³ for 2 hours [Mouse].
 GAS (LC50): Acute: 620,000 mg/m³ for 4 hours [Rat].

n-Butane:

GAS (LC50): Acute: 658,000 mg/m³ for 4 hours [Rat].
 GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse].

1,3-Butadiene (Erythrene or Pyrrolyene):

GAS (LC50): Acute: 285,000 mg/m³ for 4 hour(s) [Rat].
 GAS (LC50): Acute: 270,000 mg/m³ for 2 hours [Mouse].
 ORAL (LD50): Acute: 5,480 mg/kg [Rat].

2,2-Dimethylpropane (Neopentane)

INTRAPERITONEAL (LD50): Acute: 100 mg/kg [Mouse].

n-Pentane:

GAS (LC50): Acute: 364,000 mg/m³ for 4 hours [Rat] - Excitement.
 INTRAVENOUS (LD50): Acute: 446 mg/kg [Mouse]

Methyl and ethyl mercaptans act as respiratory poisons by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, they can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They are also eye irritants and have been shown to produce positive responses in various mutagenic assays. **Propyl mercaptans** possess similar toxic properties but at somewhat higher exposure levels.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane** and **n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane**, **butylene**, and/or **1,3-butadiene** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

At very high concentrations, **1,3-butadiene (BD)** produces narcosis with central nervous system depression and/or respiratory paralysis. Lifetime inhalation studies have shown that BD or its epoxide metabolites cause multiple organ tumors in various tissues of both rats and mice. It is also a mutagen and causes sexual organ atrophy in test animals. Epidemiology studies amongst BD workers and styrene-butadiene rubber (SBR) workers suggest that BD or BD epoxide metabolite exposures may increase the risk of cancers of the lymphohematopoietic system. Based on these various studies, IARC, NTP, OSHA, ACGIH, and EPA have determined BD to be an "animal carcinogen" and a "probable human carcinogen".

n-Butane to the Caustic Treaters

Inhalation of 500 ppm of **isopentane** or **n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9 to 12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. **n-Pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure. Rat 28-day feeding studies on both **isopentane** and **n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the butenes, pentenes, and 1,3-butadiene components of this material will readily vaporize and may contribute to generation of atmospheric smog. The atmospheric half-lives of propane, butenes, and pentenes under photochemical smog conditions are estimated to be between 5 to 8 hours; and, 1,3-butadiene's half-life is only 2 to 3 hours. Experimental data shows that significant photooxidation of 1,3-butadiene occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the butanes under photochemical smog conditions are estimated to be between 5 and 7 days. The pentanes have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of propane, isobutane, and n-butane in air (LT 8%) is not considered to be environmentally significant.
Environmental Fate	<p>Liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%); however, the toxic methyl and ethyl mercaptan components are moderately soluble in water. Therefore, this material could potentially cause harm to aquatic life.</p> <p>For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine (See Section 2 for components.)</p>

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Methyl mercaptan)		
Hazard Class	DOT CLASS: Poisonous gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance component present in this material which might require DOT HAZMAT bill-of-lading display is Methyl mercaptan .		

n-Butane to the Caustic Treaters**Placards****Emergency Response Guide No.** 119**HAZMAT STCC No.**

49 203 78

MARPOL III StatusNot a DOT "Marine Pollutant"
per 49 CFR 171.8.**SECTION 15: REGULATORY INFORMATION****TSCA Inventory**

This stream and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.

SARA 302/304The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance which might be present in these streams and is subject to this statute is **Methanethiol (Methyl mercaptan) [CAS No. 74-93-1]**.**SARA 311/312**

The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories.

Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.**SARA 313**This stream contains the following component in concentrations which are at or above de minimis levels and it is listed as toxic chemical in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:
1,3-Butadiene [CAS No. = 106-99-0] concentration: 0.1 to 6%.**CERCLA**

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance that might be present in these streams which is subject to this statute is:

Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 0.5%**CWA**

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65This material contains the following chemical substance which is known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: **1,3-Butadiene [CAS No. = 106-99-0]****New Jersey Right-to-Know Label**

For New Jersey labeling, refer to components listed in Section 2

Additional Regulatory RemarksIn regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": **1,3-Butadiene, 1-Butene, Isobutylene, 1-Pentene, and n-Pentane.**In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in these streams that are subject to this statute are: **Methyl mercaptan (Methanethiol), Ethyl mercaptan (Ethanethiol), Propane, Isobutane (Propane, 2-methyl), various Butenes, Butane, 1,3-Butadiene, Isopentane (Butane, 2-methyl), various Pentenes, and n-Pentane.**

n-Butane to the Caustic Treaters**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1 0
Revision Date 05/24/1999
Print Date Printed on 06/07/1999.

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0056
HFR # 240

Full Range Hydrotreated Naphtha

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0056
Revision Date 2/28/2005

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Light amber to amber **Odor** Hydrocarbon.Gasoline.
(Strong.)

DANGER!
Extremely Flammable.
Vapor may cause flash fire or explosion.
Vapor may travel considerable distance to source of ignition and flash back.
Harmful or fatal if swallowed - Can enter lungs and cause damage.
Repeated or excessive exposure to certain components of this mixture have been associated with central nervous system effects.
Harmful to aquatic organisms.
Possible Cancer Hazard (See Section 3)

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details
Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Full Range Hydrotreated Naphtha	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	Mixture	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable.		
Synonyms			

SECTION 2. COMPOSITION (TYPICAL)

This product may be composed, in whole or in part, of any of the following refinery streams:

Heavy Hydrodesulfurized Naphtha, [CAS No. 64742-82-1]

Light Hydrodesulfurized Naphtha, [CAS No. 64742-73-0]

This product contains the following chemicals as components of the refinery streams listed above:

Component Name(s)	CAS Registry No.	Concentration (%)
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Full Range Hydrotreated Naphtha

C10-C11 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	20 - 60
Pentanes, all isomers	Mixture	5 - 20
Octanes, all isomers	Mixture	3 - 10
Nonane, all isomers	Mixture	3 - 10
Heptane, all isomers	142-82-5	1 - 10
Hexane Isomers	Mixture	1 - 10
Xylene, all isomers	1330-20-7	1 - 8
Cyclohexane	110-82-7	1 - 5
n-Hexane	110-54-3	1 - 5
Pentenes or Pentylenes	68527-11-7	1 - 5
Benzene	71-43-2	1 - 3
Toluene	108-88-3	1 - 3
Ethylbenzene	100-41-4	0.5 - 1.5

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness.
Eye Contact	This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.
Skin Contact	May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.
Ingestion	Swallowing this material may be harmful. Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea. This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).

Chronic Health Effects Summary	Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea. Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers. Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis. This material, or a component of this material, has been shown to cause cancer in laboratory animals. However it is not likely to represent a human cancer hazard. See Toxicological Information (Section 11)
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Conditions Aggravated by Exposure	Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Peripheral Nervous System, Central Nervous System (CNS), Heart (Cardiac)
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Full Range Hydrotreated Naphtha

Target Organs Contains material which may cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, , bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

Carcinogenic Potential **CARCINOGENIC EFFECTS** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified + (Proven.) by OSHA+ (Proven.) by NIOSH [1, 3-Butadiene]. Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [1, 3-Butadiene]. Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

Full Range Hydrotreated Naphtha

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IB flammable liquid.
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)
Lower Flammable Limit	AP 1 % Upper Flammable Limit AP 7 %
Autoignition Temperature	not available
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid enter sewers or waterways.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free

Full Range Hydrotreated Naphtha

liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Do NOT use compressed air for filling, discharging or other handling operations.

Product container is not designed for elevated pressure. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Do not expose product containers to flames, sparks, heat or other potential ignition sources. Empty containers may contain product residues that can ignite with explosive force. Observe label precautions. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C). All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable regulatory requirements and the National Electrical Code.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex

Full Range Hydrotreated Naphtha



- Eye Protection** Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.
- Hand Protection** Avoid skin contact. Use heavy duty gloves constructed of chemical resistant materials such as Viton® or heavy nitrile rubber. Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.
- Body Protection** Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
C10-C11 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Not available.
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s).
Octanes, all isomers	OSHA (United States). TWA: 1000 ppm 8 hour(s).
Nonane, all isomers	ACGIH (United States). TWA: 300 ppm 8 hour(s).
Heptane, all isomers	OSHA (United States). TWA: 500 ppm 8 hour(s).
Hexane Isomers	ACGIH (United States). TWA: 200 ppm 8 hour(s).
Xylene, all isomers	ACGIH (United States). TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s).
Cyclohexane	OSHA (United States). TWA: 500 ppm 8 hour(s).
n-Hexane	ACGIH TLV (United States). TWA: 50 ppm 8 hour(s).
	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s).
	OSHA (United States). TWA: 100 ppm 8 hour(s).
	ACGIH (United States). TWA: 100 ppm 8 hour(s).
	OSHA (United States). TWA: 300 ppm 8 hour(s).
	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s).
	OSHA (United States). TWA: 500 ppm 8 hour(s).

Full Range Hydrotreated Naphtha

Pentenes or Pentylenes	Not available.
Benzene	<p>ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s).</p> <p>OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).</p>
Toluene	<p>ACGIH (United States). Skin TWA: 50 ppm 8 hour(s).</p> <p>OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm</p>
Ethylbenzene	<p>ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s).</p> <p>OSHA (United States). TWA: 100 ppm 8 hour(s).</p>

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Light amber to amber	Odor	Hydrocarbon.Gasoline. (Strong.)
Specific Gravity	Weighted average: 0.76 (Water = 1)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	85°C to 89.31°C			Melting/Freezing Point	Not available.
Vapor Pressure	The highest known value is 16.5 kPa (124 mm Hg) (at 20°C) (n-Hexane). Weighted average: 4.91 kPa (36.83 mm Hg) (at 20°C)			Volatility	760 g/l VOC (w/v)
Solubility in Water	Very slightly soluble in cold water. (<0.1 % w/w)			Viscosity (cSt @ 40°C)	not available
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks and flame.		
Materials Incompatibility	Incompatible with strong acids, strong bases, and strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

Full Range Hydrotreated Naphtha

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Pentanes, all isomers

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Heptane, all isomers

n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

Benzene

ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].

INHALATION (LC50):

Full Range Hydrotreated Naphtha

(VAPOR): Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD50), Acute: 3,500 mg/kg [Rat].

DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory

Full Range Hydrotreated Naphtha

animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	No data.
Environmental Fate	This product will normally float on water. Components will evaporate rapidly. This material may be harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. The log Kow value for this product is expected to be in the range of 3.3 to 6.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard

Full Range Hydrotreated Naphtha

SARA 313 Toxic Chemical Notification and Release Reporting

This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:

Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 4.5%
Cyclohexane [CAS No.: 110-82-7] Concentration: 3%
n-Hexane [CAS No.: 110-54-3] Concentration: 3%
Benzene [CAS No.: 71-43-2] Concentration: 2%
Toluene [CAS No.: 108-88-3] Concentration: 2%
Ethylbenzene [CAS No.: 100-41-4] Concentration: 1%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:

Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lb. (45.36 kg) Concentration: 4.5%
Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lb. (453.6 kg) Concentration: 3%
n-Hexane [CAS No.: 110-54-3] RQ = 5000 lb. (2268 kg) Concentration: 3%
Benzene [CAS No.: 71-43-2] RQ = 10 lb. (4.536 kg) Concentration: 2%
Toluene [CAS No.: 108-88-3] RQ = 1000 lb. (453.6 kg) Concentration: 2%
Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lb. (453.6 kg) Concentration: 1%

Clean Water Act (CWA)

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Benzene: 3%
Toluene: 3%
Ethylbenzene: 0.6%

New Jersey Right-to-Know Label

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

Additional Regulatory Remarks

No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 2/28/2005
Print Date Printed on 2/28/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

Full Range Hydrotreated Naphtha

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Sour Butane/Butene Feeds to B/B Extractor Pretreaters

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0057
Revision Date 05/26/1999

Hazard Rankings		
	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1
COR		
* = Chronic Health Hazard		

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

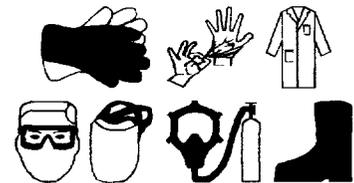
Emergency Overview

Physical State	Liquefied Gas.		
Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg or skunk odor is unreliable as a warning of possible exposure

DANGER! Extremely flammable and poisonous liquefied gas; vapor may cause flash fire or explosion!
May form explosive peroxides on exposure to air!
High pressure and rapid diffusion hazard!
Liquid or compressed gas contact may cause frostbite or freeze burns!
Contains Hydrogen Sulfide (H₂S)! Corrosive to some metals!
May be harmful or fatal if inhaled or absorbed through the skin!
High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation!
Vapor or mist may cause mild to severe eye, mucous membrane, and respiratory tract irritation and inflammation!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Overexposures may cause target organ effects such as eye, lung, brain, sympathetic and central nervous systems, heart, blood, liver, and/or kidney damage!
Contains low levels of 1,3-Butadiene! Based upon laboratory animal tests, cancer, mutagenic, and reproductive hazards might exist!
May cause blood system disorders and/or genetic damage!
May adversely affect reproduction or reproductive development!

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Sour Butane/Butene Feeds to B/B Extractor Pretreaters	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110057	Medical Emergency	(918) 495-4700
CAS Number	Mixture (See Section 2.)	CHEMTREC Emergency	(800) 424-9300
Product Family	Liquefied Gas Mixture of Sour Thermal and Catalytic Cracked C4 Hydrocarbon Streams		
Synonyms	Unrefined C4-Rich Liquefied Petroleum Gases, Unsweetened C4-Rich Gases, C4-Rich Catalytically and Thermally Cracked Gases, Feeds to the BRU V-101 and V-102 Caustic Treaters; BRU No 2 Deisobutanizer Tower Overhead Stream; FCCU (732) No. 1 and No. 2 Debutanizer Tower Overhead B/B's Streams, 736 and 737 Coker Units Depropanizer Tower Bottoms B/B's Streams; LPG Blend containing Hydrogen Sulfide and Mercaptans, C3-C5 Hydrocarbons, H ₂ S, and R-SHs		

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Liquefied Petroleum Gases	68476-85-7	100
2) C4-Rich Gases	68477-85-0	97-100
3) Butenes or Butylenes	25167-67-3	40-60
4) Iso-Butane	75-28-5	25-40
5) Isobutylene	115-11-7	5-20
6) n-Butane	106-97-8	5-15
7) Iso-Pentane	78-78-4	1-5
8) Propane	000074-98-6	0-3
9) Propylene	115-07-1	0-2
10) n-Pentane	109-66-0	0-2
11) 1,3-Butadiene	106-99-0	0.1-1
12) Hydrogen sulfide	7783-06-4	0.1-1
13) Methyl mercaptan	74-93-1	0-1
14) Ethyl mercaptan	75-08-1	0-1

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact. Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of **hydrogen sulfide (H₂S)** are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)

Additionally, at least one component of this liquefied gas mixture is a "simple asphyxiant". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.

Eye Contact Vapors may cause moderate to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentration of **hydrogen sulfide** and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."

Skin Contact Direct contact with an expanding liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. **Hydrogen sulfide and methyl mercaptan** can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.

Ingestion Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus.

Chronic Health Effects Summary Subchronic exposure to low levels of **hydrogen sulfide** can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.

Chronic inhalation to components of this mixture (**propane, propene, n-butane, and n-pentane**) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of **epinephrine (adrenaline)-like** drugs.

1,3-Butadiene (BD), a minor component of this stream, has been shown to be mutagenic and produces multiple organ tumors in various tissues of laboratory rodents. BD also causes sexual organ atrophy in test animals. (See Section 11.)

**Sour Butane/Butene Feeds
to B/B Extractor Pretreaters**

Conditions Aggravated by Exposure	Personnel with eye, skin, cardiovascular, pulmonary, blood, liver, kidney, or neurological disorders, high blood pressure, and chronic respiratory diseases or those with a compromised ability to use oxygen (asthmatics, anemics, etc.) should take additional precautions to minimize or avoid exposure.
Target Organs	These streams are toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, liver, kidneys, and possibly, the endocrine and reproductive systems.
Carcinogenic Potential	These refinery streams contain 1,3-butadiene at concentrations above 0.1%. 1,3-Butadiene is considered carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910 1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, obtain medical attention as soon as possible. Do not use ointments.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Liquefied Gas.		
Flash Point/Method	CLOSED CUP AP -107° to -73°C (-160° to -100°F) (Estimated)		
Lower Flammable Limit	AP 1.6	Upper Flammable Limit	AP 45%
Auto-Ignition Temp.	AP 260°C (500°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans.		
Special Properties	This liquefied gas mixture is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it may contain hydrogen sulfide (H₂S), mercaptans, and/or simple asphyxiants. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking (See appropriate API and NACE standards.)

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

Hand Protection	Avoid skin contact and use gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves.
Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable liquefied gases. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2)
General Comments	Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against hydrogen sulfide, mercaptans, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1998] TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) [1989]
2) Methyl mercaptan	TWA: 5 (ppm) from ACGIH (TLV) [1997] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998] TWA: 0.5 CEIL: 10 (ppm) from OSHA [1989]
3) Ethyl mercaptan	TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998] TWA: 0.5 CEIL: 10 (ppm) from OSHA (PEL) [1989]
4) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
5) Propane	TWA: 2500 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
6) Propylene	Simple asphyxiant
7) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1998] TWA: 800 (ppm) from OSHA (PEL) [1989]
8) 1,3-Butadiene ("A2" and "Z-2" Carcinogen)	TWA: 2 (ppm) from ACGIH (TLV) [1998] TWA: 2 STEL: 5 AL: 1 (ppm) from OSHA (PEL) [1994]
9) Pentanes	TWA: 600 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1976]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg or skunk odor is unreliable as a warning of possible exposure
Specific Gravity	AP 0.56 to 0.62 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to acidic H ₂ SO ₄ .	Vapor Density	AP 1.9 to 2.1 (Air = 1)
Boiling Point/Range	AP -60°C to 36°C (-75° to 97°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point		AP	-187° to -83°C (-305° to -117°F) at 14.7 psia
Vapor Pressure	45 to 190 psia at 100°F	Viscosity (cSt @ 40°C)		AP	Not applicable
Solubility in Water	Moderately soluble in cold water.	Volatile Characteristics		AP	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Hydrogen Sulfide and Mercaptans Content = 0.1 to 3 Vol.%; C3-C5 Alkane, Isoparaffin, and Alkene Hydrocarbons Content = 97 to 99.3 Wt.% (ASTM D-1319), Gross Heat of Combustion at 60°F = AP 21,300 Btu/lb or 2,350 Btu/cu.ft., Average Density at 60°F = AP 5.00 lbs./gal. (ASTM D-2161).				

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Hydrogen sulfide GAS (TCLo): Acute: 10 ppm for 15 minutes (Human) - Eye irritation GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation GAS (LC100) Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death GAS (LCLo): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.</p> <p>Methanethiol (Methyl mercaptan) GAS (LC50): Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration. GAS (LC50): Acute: 6,530 ug/m³ for 2 hours [Mouse].</p> <p>Ethanethiol (Ethyl mercaptan) GAS (LC50): Acute: 2,770 ppm for 4 hours [Mouse] - Excitment, motor activity changes, and cyanosis. GAS (LC50): Acute: 4,420 ppm for 4 hours [Rat] - Excitment, spastic parapysis, and cyanosis ORAL (LD50): Acute: 682 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis INTRAPERITONEAL (LD50): Acute: 226 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.</p> <p>Propylene. GAS (LC50): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse]. GAS (TCLo): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.</p> <p>Iso-Butane: GAS (TCLo): Acute: 1,040,000 mg/m³ for 2 hours [Mouse] - Excitment. GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p> <p>Iso-Butene (Isobutylene or 2-Methylpropene) GAS (LC50) Acute: 415,000 mg/m³ for 2 hours [Mouse]. GAS (LC50): Acute: 620,000 mg/m³ for 4 hours [Rat].</p> <p>n-Butane: GAS (LC50): Acute: 660,000 mg/m³ for 4 hours [Rat]. GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse].</p> <p>1,3-Butadiene (Erythrene or Pyrrolyene): GAS (LC50): Acute: 285,000 mg/m³ for 4 hour(s) [Rat]. GAS (LC50): Acute: 270,000 mg/m³ for 2 hours [Mouse]. ORAL (LD50): Acute: 5,480 mg/kg [Rat].</p> <p>n-Pentane: GAS (LC50): Acute: 364,000 mg/m³ for 4 hour(s) [Rat] - Excitment. INTRAVENOUS (LD50) Acute: 446 mg/kg [Mouse]</p>
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Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

Methyl and ethyl mercaptans act as respiratory poisons by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, they can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They are also eye irritants and have been shown to produce positive responses in various mutagenic assays.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). **Propylene** has also been found to be a cardiac sensitizer in dogs. An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

In humans, at concentrations of 6-4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice; however, it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

At very high concentrations, **1,3-butadiene (BD)** produces narcosis with central nervous system depression and/or respiratory paralysis. Lifetime inhalation studies have shown BD or its epoxide metabolites cause multiple organ tumors in various tissues of both rats and mice. It is also a mutagen and causes sexual organ atrophy in test animals. Epidemiology studies amongst BD workers and styrene-butadiene rubber (SBR) workers suggest that BD or BD epoxide metabolite exposures may increase the risk of cancers of the lymphohematopoietic system. Based on these various studies, IARC, NTP, OSHA, ACGIH, and EPA have determined BD to be an animal carcinogen and a probable human carcinogen. Laboratory animals have exhibited a higher degree of narcosis when exposed to combinations of butane, butenes, and 1,3-butadiene (additive effect), than the degree of narcosis exhibited following exposure to each gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **propane, propylene, butenes, hydrogen sulfide, and the mercaptan** components of these streams may contribute to generation of atmospheric smog. The atmospheric half-lives of **propane, propylene, and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours, and, **1,3-butadiene's** half-life is only 2 to 3 hours. Experimental data shows that significant photooxidation of **propylene and 1,3-butadiene** occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. The **pentanes** have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of **propane, isobutane, and n-butane** in air (LT 8%) are not considered to be environmentally significant. **Hydrogen sulfide** residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

Environmental Fate

Liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%), however, the toxic hydrogen sulfide, methyl mercaptan, and ethyl mercaptan components are moderately soluble in water. Therefore, this material could potentially cause harm to aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U S. Department of Transportation regulated material		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Methyl mercaptan)		
Hazard Class	Class 2.3 Poisonous gas.	Packing Group(s)	Not applicable
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Hydrogen sulfide and Methyl mercaptan		
Placards			Emergency Response Guide No. 119
		HAZMAT STCC No.	49 203 78
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances which might be present in these streams and are subject to this statute are: Hydrogen sulfide [CAS No. 7783-06-4] and Methanethiol (Methyl mercaptan) [CAS No. 74-93-1]
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.

Sour Butane/Butene Feeds to B/B Extractor Pretreaters

SARA 313	These streams contain the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Propylene or Propene [CAS No. 115-07-1] concentration: 0 to 2% 1,3-Butadiene [CAS No. 106-99-0] concentration: 0.1 to 1%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in these streams which are subject to this statute are: Hydrogen sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 1% Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] (RQ = 100 lbs. [45.36 kg]) conc.: 0 to 1%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA) Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802
California Proposition 65	These streams contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: 1,3-Butadiene [CAS No. 106-99-0].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in these streams as "Volatile Organic Compounds (VOC)" that contribute significantly to air pollution which endangers public health and welfare". Propylene (Propene), 1,3-Butadiene, 1-Butene, Isobutylene, Isopentane, 1-Pentene, and n-Pentane. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in these streams that are subject to this statute are: Hydrogen sulfide, Methyl mercaptan (Methanethiol), Ethyl mercaptan (Ethanethiol), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, n-Butane, 1,3-Butadiene, Isopentane (Butane, 2-methyl), 2,2-Dimethylpropane (Neopentane), various Pentenes, and n-Pentane

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 05/26/1999
Print Date Printed on 06/03/1999

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

**Sour Butane/Butene Feeds
to B/B Extractor Pretreaters****DISCLAIMER OF LIABILITY**

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***** END OF MSDS *****



BTU Recycle Gas

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0058
Revision Date 01/31/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Compressed gas/liquid
Color Colorless **Odor** Odorless and tasteless

DANGER! Extremely flammable compressed gas;
vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
**High concentrations of vapor reduce oxygen available for
breathing and may cause central nervous system (CNS)
depression or suffocation!**
Compressed gas or liquid contact may cause frostbite or freeze burns!
**Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats)!**

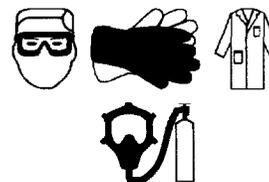
Hazard Rankings

	HMIS	NFPA
Health Hazard	2	1
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	BTU Recycle Gas	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068478002*	Medical Emergency	(918) 495-4700
CAS Number	68478-00-2	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Hydrogen and C1-C4 Alkane Hydrocarbons		
Synonyms	High-Hydrogen Content Gas, Demoisurized Hydrogen with C1-C4 Hydrocarbons, Recycle Gas from the Benzene-Toluene Unit, Hydrogen-rich Recycle Gases (Petroleum)		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrogen	1333-74-0	80-95
2) Methane	74-82-8	1-10
3) Ethane	74-84-0	1-5
4) Propane	74-98-6	1-3
5) Isobutane	75-28-5	0-2
6) Nitrogen	7727-37-9	0-2

BTU Recycle Gas

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation Skin contact Eye Contact

Signs and Symptoms of Acute Exposure

Inhalation	Several components of this gas mixture are "simple asphyxiants" (see Section 8) Their vapors can displace the amount of oxygen in air available to breathe below that necessary to sustain life, especially if working in confined spaces Breathing vapors may also irritate the respiratory tract and cause central nervous system (CNS) depression Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, blurred vision, memory loss, drowsiness, fatigue, rapid or difficult breathing, confusion, vertigo, loss of consciousness, convulsions, coma, and even death, depending upon concentration level and duration of exposure
Eye Contact	This gas is non-irritating, however, direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn "
Skin Contact	Direct contact with an pressurized/liquefied expanding gas may produce severe and possibly permanent skin damage from frostbite or freeze burns
Ingestion	Ingestion is not an applicable route of exposure for gases
Chronic Health Effects Summary	There is no evidence that long-term, low-level exposure to components of this gas mixture cause any chronic adverse health effects in animals or humans
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, or cardiovascular conditions should avoid exposure Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of "simple asphyxiants"
	Exposure to high concentrations of propane , a minor component of this material, may increase the sensitivity of the heart to epinephrine (adrenalin) and catecholamine-like drugs . Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians")
Target Organs	The substance is toxic to mucous membranes, skin, eyes, central nervous system (CNS), and possibly the heart
Carcinogenic Potential	This material does not contain any components at concentrations at or above 0.1% which are considered to be carcinogenic by OSHA, IARC, or NTP

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual Seek medical attention immediately
Eye Contact	Check for and remove contact lenses Irrigate the eyes with copious amounts of clean, low-pressure, room-temperature water Do not use hot water! Do not use eye ointment unless directed to by a physician Seek medical attention if excessive tearing, irritation, or pain persists

BTU Recycle Gas

Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F) DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area Seek medical attention if tissue appears damaged or if pain persists
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry
Notes to Physician	If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis Monitor arterial blood gases and chest x-ray in cases with significant exposure If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse) If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas		
Flash Point Method	-185°C (-301°F) (Estimated)		
Lower Flammable Limit	AP 2.0%	Upper Flammable Limit	AP 75%
Autoignition Temperature	AP 400°C (752°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes and unburned hydrocarbons		
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air If released, immediately evacuate personnel to a safe upwind area It is lighter than air and rises rapidly collecting in the upper portions of confined spaces Exposed to an ignition source, it can ignite with explosive force Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard Evacuate all non-essential personnel to an area upwind Remove all potential ignition sources Safety stop the source gas flow using non-sparking tools Allow the substance to evaporate Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres

Closed gas systems form white-colored frost at the point of a leak Do not direct water at the source of leak If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse Do not touch or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing Use water spray to reduce vapors or divert vapor cloud drift Prevent this material's entry into waterways, sewers, basements, or confined areas
Caution: Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid

BTU Recycle Gas

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

This gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed.

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling pressurized and/or liquefied gases. Safety glasses equipped with side shields or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.

BTU Recycle Gas

Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.) Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
Respiratory Protection	Odor is not an adequate warning for potentially hazardous air concentrations. For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).
General Comments	For an explanation about some of the occupational exposure limits shown below, refer to the definition of " Simple Asphyxiant " presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents handbook. Releases of these gases may cause atmospheres, some oxygen-deficient (LT 21 Vol % in air), which can have flammable/explosive potential. DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen	Simple asphyxiant
2) Nitrogen	Simple asphyxiant
3) Methane	Simple asphyxiant
4) Ethane	Simple asphyxiant
5) Propane	TWA. 2500 (ppm) from ACGIH (TLV) TWA. 1000 (ppm) from OSHA (PEL)
6) Liquefied Petroleum Gas (L P G)	TWA. 1000 (ppm) from ACGIH (TLV) TWA. 1000 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Compressed gas/liquid	Color	Colorless	Odor	Odorless and tasteless
Specific Gravity	0.07 to 0.38 (Water = 1)	pH	Not applicable	Vapor Density	0.07 to 1.04 (Air = 1)
Boiling Point/Range	-253° to -41°C (-423° to -43°F) at 14.7 psia			Melting/Freezing Point	-260° to -169°C (-435° to -272°F) at 14.7 psia
Vapor Pressure	205 to 250 psia at 40°C (104°F)			Viscosity (cSt @ 40°C)	Not applicable
Solubility in Water	Negligible in cold water (LT 0.01 Wt %)			Volatile Characteristics	This material is normally a gas. If released in liquid form, it will completely evaporate very quickly.
Additional Properties	This gas' low boiling point temperature intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 22,000 Btu/lb or 1,000 Btu/cu ft.				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

BTU Recycle Gas**SECTION 11: TOXICOLOGICAL INFORMATION**

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen, methane, and ethane, major components of this material, are "simple asphyxiants" High concentrations of this gas can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia), especially if trapped in confined spaces Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol % in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs

SECTION 12: ECOLOGICAL INFORMATION**Ecotoxicity**

Ecological effects testing has not been conducted on this material Releases are expected to cause only localized non-persistent environmental damage

Environmental Fate

Hydrogen and light alkane/alkene gases are essentially insoluble in water (LT 0.1%); and therefore, this material will not cause harm to aquatic life These pressurized gas mixtures will normally disperse rapidly in air if released

The atmospheric half-lives of **methane, ethane, and propane** under photochemical smog conditions are estimated to be between 5 to 8 hours Photooxidation of **propane** in air (LT 8%) is not considered environmentally significant

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine (See Section 2 for components)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001) Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible Venting of this gas to the atmosphere should be avoided Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags

SECTION 14: TRANSPORT INFORMATION**DOT Status**

This material is regulated by the U.S. Department of Transportation (DOT).

Proper Shipping Name

Hydrogen and methane mixtures, compressed

Hazard Class

DOT Class. 2.1 (Flammable gas).

Packing Group(s)

Not applicable

UN/NA ID

UN1049

Reportable Quantity

A Reportable Quantity (RQ) has not been established for any components of this material

BTU Recycle Gas**Placards****Emergency Response Guide No.** 115**HAZMAT STCC No.**

49 057 29

MARPOL III StatusNot a DOT "Marine Pollutant"
per 49 CFR 171.8**SECTION 15: REGULATORY INFORMATION**

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Sudden Release of Pressure Hazard, and Acute (Immediate) Health Hazard
SARA 313	This material does not contain any components in concentrations at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This material is not known to contain chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a release.
CWA	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are Hydrogen, Methane, Ethane, Propane, and Isobutane.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	2.0
Revision Date	01/31/2002
Print Date	Printed on 01/31/2002

BTU Recycle Gas**ABBREVIATIONS**

AP = Approximately EQ = Equal > = Greater Than < = Less Than NA = Not Applicable ND = No Data NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association
IARC = International Agency for Research on Cancer NTP = National Toxicology Program
NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration
NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System
NFPA = National Fire Protection Association EPA = Environmental Protection Agency

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***** END OF MSDS *****



Coker Naphtha Splitter Overhead

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0060
Revision Date 10/16/2001

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product

Emergency Overview

Physical State Liquid
Color Transparent, colorless **Odor** Light hydrocarbon Odor threshold is 1 to 7 ppm in air

DANGER! Extremely flammable liquid; vapor may cause flash fire or explosion!
High vapor concentrations reduce oxygen available for breathing!
Mist or vapor may irritate the eyes, nose, and respiratory tract!
Liquid contact may cause mild to moderate eye irritation and/or mild to severe skin irritation!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss and/or liver, kidney, or peripheral nervous system damage!
May be harmful or fatal if ingested! Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Contains low levels of Benzene! Potential cancer hazard!
May cause anemia, leukemia, and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
Based upon animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

Hazard Rankings

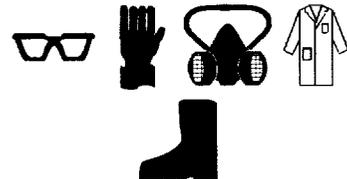
	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements See Section 8 for Details

The personal protective equipment depicted below is recommended for use only at this facility



SECTION 1: IDENTIFICATION

Trade Name	Coker Naphtha Splitter Overhead	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	3641836418	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	64741-74-8	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	C4-C8 Petroleum Hydrocarbons		
Synonyms	534 Still Depentanizer Overhead Product; Thermocracked Naphtha Splitter Overhead, Light Thermocracked Naphtha, Light Thermal Cracked Naphtha (Petroleum), Unstabilized Light Coker Naphtha, Untreated Coker Gasoline; Light Delayed Coker Gasoline, Coker Pentenes/Hexenes, C4-C8 Alkanes/Alkene Hydrocarbons Mix.		

Coker Naphtha Splitter Overhead

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Light Thermal Cracked Naphtha (Petroleum)	64741-74-8	100
2) Butanes	Mixture	1-10
3) Butenes or Butylenes	25167-67-3	1-5
4) Pentanes	Mixture	15-35
5) Pentenes or Pentylenes	68527-11-7	15-25
6) Cyclopentane	287-92-3	1-3
7) Hexane Isomers	Mixture	15-25
8) C6-C8 alpha-Alkenes	68526-99-8	5-10
9) Methylcyclopentane	96-37-7	1-5
10) n-Hexane	110-54-3	5-15
11) Cyclohexane	110-82-7	1-3
12) Benzene	71-43-2	0 1-1
13) Heptanes	Mixture	2-5
14) Octanes	Mixture	0-2

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of this mixture's vapor may cause upper respiratory tract irritation, headache, nausea, vomiting, and/or central nervous system (CNS) depression. Components of this mixture may also produce mild narcotic effects. Symptoms may include euphoria, excitation or giddiness, abdominal pain, loss of appetite, fatigue, muscular weakness, and staggering gait. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. High vapor concentrations can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 to 10,000 ppm for only 5 minutes.
Eye Contact	Actual human exposures indicate that this product can cause mild to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling. Liquid contact may cause conjunctivitis, small areas of superficial corneal necrosis, and/or permanent clouding of the cornea.
Skin Contact	Actual human exposures indicate that this product can cause mild to severe skin irritation. Short-term contact symptoms include redness, itching, and burning or blistering of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure. However, if swallowed, this material may cause a "freeze burn" or irritation with a burning sensation of the mucous membranes in the mouth, throat, and esophagus. The liquid portion can be readily absorbed by the stomach and intestinal tract. Symptoms include nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for naphtha and gasoline abusers. Intentional misuse by deliberately concentrating and inhaling this material may be harmful or fatal. Even with acute exposures, n-hexane is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, 2,5-hexanedione , has been shown to cause degeneration of the testes.

Coker Naphtha Splitter Overhead

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents. (See Section 11.)

Conditions Aggravated by Exposure Personnel with pre-existing nervous system disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material. They should take additional precautions to minimize or avoid exposure.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs The substance is toxic to lungs, nervous system, especially the peripheral nerves, brain, liver, kidneys, blood and blood-forming tissues, mucous membranes, skin, eyes, and possibly, the heart, lymph nodes, and reproductive systems.

Carcinogenic Potential This material contains benzene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input checked="" type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Coker Naphtha Splitter Overhead

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable ¹		
Flash Point Method	CLOSED CUP <-45°C (-50°F) (Tagliabue [ASTM D-56])		
Lower Flammable Limit	0.9% in Air	Upper Flammable Limit	7.8% in Air
Autoignition Temperature	260° to 280°C (500° to 535°F) by ASTM E-659.		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	Extremely Flammable Liquid ¹ . This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Mists or sprays may be flammable at temperatures below the flash point. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard if released into confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing middle distillates or other higher flash point products. To reduce this hazard, receiving containers should always be grounded and loading nozzle must be kept in contact with container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.		
Protection of Fire Fighters	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.		

Coker Naphtha Splitter Overhead

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all potential ignition sources because a liquid spill will vaporize rapidly. A vapor-suppressing foam may be used to reduce vapors. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material even when wearing proper respiratory equipment and fire-resistant protective clothing. Do not direct water at the source of leak, but, use water spray to reduce vapors or divert vapor cloud drift. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Spills will most likely need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Coker Naphtha Splitter Overhead

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below), then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

The personal protective equipment depicted below is recommended for use only at this facility.



- Eye Protection** Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent). During transfer operations or when this material is being released under pressure, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Suitable eye wash water should be readily available.
- Hand Protection** Avoid skin contact and use impervious, chemically-resistant gloves (e.g., disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with vapors and liquid. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use this material as a skin cleaner.
- Body Protection** Avoid skin contact. It is recommended that fire-retardant garments (e.g., Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
- Respiratory Protection** For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g., ANSI Z88.2).
- General Comments** Releases of this product may create flammable, explosive, and/or oxygen-deficient atmospheres (<19.5 Vol % in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. If the Lower Explosive Limit (LEL) for this product is exceeded, all entry into the contaminated area/confined space should be prohibited. Odor is an inadequate warning for hazardous conditions.

Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Gasoline ("A3" Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) TWA: 300 STEL: 500 (ppm) from OSHA (PEL)
2) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
3) Butane	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
4) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
5) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 (ppm) from OSHA (PEL) [Proposed]
6) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV)

Coker Naphtha Splitter Overhead

7) 1-Hexene	TWA 500 STEL 1000 (ppm) from OSHA (PEL) [Proposed] TWA: 30 (ppm) from ACGIH (TLV)
8) Hexane (n-Hexane)	TWA 50 (ppm) from ACGIH (TLV) [Proposed] TWA 50 (ppm) from ACGIH (TLV) - SKIN TWA 50 (ppm) from OSHA (PEL) [Proposed] TWA 500 (ppm) from OSHA (PEL)
9) Cyclohexane	TWA 300 (ppm) from ACGIH (TLV) TWA 100 (ppm) from ACGIH (TLV) [Proposed] TWA 300 (ppm) from OSHA (PEL)
10) Heptane (n-Heptane)	TWA 400 STEL 500 (ppm) from ACGIH (TLV) TWA: 400 STEL 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
11) Benzene ("A1" and "Z-2" Known Human Carcinogen)	TWA: 0.5 STEL 2.5 (ppm) from ACGIH (TLV) - SKIN TWA 1 STEL 5 AL 0.5 (ppm) from OSHA (PEL) - SKIN
12) Octane, all isomers	TWA 300 (ppm) from ACGIH (TLV) TWA 300 STEL 375 (ppm) from OSHA (PEL) [Proposed] TWA 500 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, colorless.	Odor	Light hydrocarbon. Odor threshold is 1 to 7 ppm in air
Specific Gravity	0.63 to 0.68 (Water = 1)	pH	Not applicable.	Vapor Density	2.0 to 3.2 (Air = 1)
Boiling Point/Range	-12° to 99°C (10° to 210°F) [ASTM D-3710]	Melting/Freezing Point			-160° to 7°C (-255° to 45°F) at 14.7 psia [ASTM D-97]
Vapor Pressure	110 to 125 mm of Hg at 20°C (68°F) or 35 to 52 psia at 37.8°C (100°F)	Viscosity (cSt @ 40°C)			0.5 to 1.0 [ASTM D-445]
Solubility in Water	Slightly soluble in cold water (<0.2%)	Volatile Characteristics			Volatile Organic Compounds (VOC) Content = 100%, 900 gm/L
Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 58 to 79 Wt % (ASTM D-3257), C6-C7 Aromatic Hydrocarbons Content = 0.15 to 2 Wt % (ASTM D-2267), Olefin Hydrocarbons Content = 21 to 40 Wt % (ASTM D-1319), Average Density at 60°F = 5.452 lbs/gal (ASTM D-2161), Dry Point Temperature = 230°F (110°C) (ASTM D-86), Evaporation Rate = 7 to 10 when n-Butyl acetate = 1.0, Sulfur Content = <0.05 Wt % (ASTM D-2922); Heat Value = 20,000 to 21,000 Btu or AP 4,000 Btu/cu.ft.				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Polymerization can occur under conditions of extremely high temperature and pressure
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	No substances are readily identified from composition; but, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Coker Naphtha Splitter Overhead

Thermal Cracked Naphtha (a similar material):

VAPOR	(LC ₅₀)	Acute	>5,000 mg/M ³ (Rat screen level) (4 hours) - Somnolence
ORAL	(LD ₅₀)	Acute	>5,000 mg/kg (Rat screen level) - Diarrhea, somnolence, & hypermotility.
DERMAL	(LD ₅₀)	Acute	>2,000 mg/kg (Rat screen level)
BUEHLER DERMAL		Acute	Non-sensitizing (Guinea Pig)

Unleaded Gasoline (a similar material):

VAPOR	(TE _{Lo})	Acute	140 ppm (Human) (8 hours) - Mild eye irritant!
VAPOR	(TE _{Lo})	Acute	500 ppm (Human) (1 hour) - Moderate eye irritant!
VAPOR	(TC _{Lo})	Acute	900 ppm (Human) (1 hour) - CNS and pulmonary effects
DERMAL	(TD _{Lo})	Acute	53 mg/kg (Human) - Skin allergy effects.
VAPOR	(LC ₅₀)	Acute	101,200 ppm (Rat, Mouse, & Guinea Pig) (5 minutes)

In a large epidemiological study on over 15,000 persons, no increased risk of kidney cancer was seen in association with **gasoline** exposures for employees at several petroleum refineries or amongst residents located near these refineries. In another study, no increased risk of kidney cancer was seen amongst petroleum refinery workers, but there was a slight trend in kidney cancers among service station employees, especially after a 30-year latency period.

Two-year inhalation toxicity studies with **fully vaporized unleaded gasoline** (at 67, 292, & 2,056 ppm in air) produced kidney damage and kidney tumors in male rats, but not in female rats or mice of either sex. Female mice developed a slightly higher incidence of liver tumors compared to controls at the highest concentration. Results from subsequent scientific studies suggest that the kidney damage, and probably the kidney tumor response, is unique to the male rat. An EPA draft policy statement takes account of alpha-2u-globulin findings as a basis for discarding male rat kidney data in determining whether gasoline is a carcinogen. In additional rat studies, the maternal and developmental NOAEL was determined to be 9,000 ppm (75% of the LEL value). Under conditions of the study, **volatilized unleaded gasoline vapor** did NOT produce evidence of any type of developmental toxicity.

There were no benzene-induced blood toxin or leukemia effects noted in laboratory animals following long-term exposures to **fully-volatilized unleaded gasoline vapor containing 2 vol.% benzene**. However, the relative risk to humans for benzene in gasoline is still unknown.

An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Intentional abuse of products containing **n-hexane** have been associated with permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially among women. Chronic repeated or prolonged overexposure to **n-hexane**, either by inhalation or skin absorption, has been associated with peripheral neuropathy in both human workers and rodents. The neurotoxic properties of **n-hexane** may increase with concurrent exposure to methyl ethyl ketone, methyl isobutyl ketone or toluene. **n-Hexane** has been associated with testicular degeneration and epididymal lesions in rats. Also, **n-hexane** produced fetal toxicity and reduced fetal weight in mice at maternally toxic doses.

Other **hexane isomers** can cause eye and skin irritation, but they were not shown to be mutagenic in the Salmonella/ microsome (Ames) assay. They are not considered neurotoxic or carcinogenic.

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depression, narcosis, and death at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral routes, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys

Coker Naphtha Splitter Overhead

and brain Cyclohexane does not act as a promotor for tumors on mice when exposed to dimethylbenzanthracene Further, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation, however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days These chromosomal aberrations did not appear to be dose-related

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes Prolonged and repeated exposure to high concentrations of benzene is associated with injury to blood forming organs and anemia Consumption of alcohol may increase the blood system changes related to benzene exposure It is linked to the development of acute myelogenous leukemia (AML) in humans NTP, IARC, and OSHA list benzene as carcinogenic to humans Studies of workers exposed to high levels of benzene have identified humoral and cellular immunity impairment and a decrease in levels of circulating leukocytes. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice Animal studies have shown testicular effects and alterations in reproductive cycles with some evidence of developmental effects. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity

n-Heptane is a skin, mucous membrane, and respiratory tract irritant, but non-irritating to the eyes It is readily absorbed by either inhalation or dermal exposure Overexposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans One occupational exposure study with **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas Polyneuropathy was reversible within a year following removal of exposure n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life This material will normally evaporate rapidly if spilled If released, volatile **aromatic hydrocarbon components (benzene and toluene)** may contribute to the creation of atmospheric smog. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days Photooxidation of **isobutane and n-butane** in air (<8%) is not considered to be environmentally significant **Isopentane, n-pentane, n-hexane, hexane isomers, n-heptane, heptane isomers, and iso-octane** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present **Cyclohexane** has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present

This material is potentially toxic to freshwater and saltwater ecosystems Using Rainbow Trout (*Salmo irideus*), various Gasolines showed an LC100 (the Lethal Level) from 40 ppm to 100 ppm in ambient stream water. A 24-hour TLm (Median Toxic Limit) resulted in 90 ppm when using juvenile American Shad (*Squalus cephalus*). Using Bluegill Sunfish (*Lepomis macrochirus*), Grey Mullet (*Chelon labrosus*), and Gulf Menhaden (*Brevoortia patronus*), Gasoline showed a 96-hour LC50 of 8 ppm, 2 ppm, and 2 ppm, respectively

Environmental Fate

This material is potentially toxic to freshwater and saltwater ecosystems It will normally float on water with its lighter components evaporating rapidly In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material

Coker Naphtha Splitter Overhead

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine (See Section 2 for components)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Petroleum distillates, n.o.s. (Pentanes, Pentenes, and/or Hexanes)		
Hazard Class	DOT Class: 3 (Flammable liquid).	Packing Group(s)	PG I
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Benzene, n-Hexane, and/or Cyclohexane .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 123 87
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.

Coker Naphtha Splitter Overhead**SARA 313**

This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313

n-Hexane [CAS No. 110-54-3] concentration: 5 to 15%
Cyclohexane [CAS No. 110-82-7] concentration: 1 to 3%
Benzene [CAS No. 71-43-2] concentration: 0.1 to 1%.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this material which are subject to this statute are:

n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 5 to 15%
Cyclohexane [CAS No. 110-82-7] (RQ = 1,000 lbs. [453.6 kg]) concentration: 1 to 3%
Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 1%
Toluene [CAS No. 108-88-3] (RQ = 1,000 lbs. [453.6 kg]) concentration: 0.05 to 0.9%
2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1,000 lbs. [453.6 kg]) conc.: 0 to 1%.

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: **Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].**

New Jersey Right-to-Know Label

For New Jersey labeling refer to components listed in Section 2.

Additional Regulatory Remarks

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13). This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of **Cyclohexane [CAS No. 110-82-7]**, this product might be subject to US EPA's one-time only per country export notification requirements.

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare: **1-Butene [CAS No. 106-98-9], Isopentane [CAS No. 78-78-4], 1-Pentene [CAS No. 109-67-1], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 71-43-2], Methylcyclohexane [CAS No. 108-87-2], and Toluene [CAS No. 108-88-3].**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are **Isobutane (Propane, 2-methyl), various Butenes, n-Butane, Isopentane (Butane, 2-methyl), various Pentenes, and n-Pentane.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	2.0
Revision Date	10/16/2001
Print Date	Printed on 10/16/2001

Coker Naphtha Splitter Overhead**ABBREVIATIONS**

AP = Approximately EQ = Equal > = Greater Than < = Less Than NA = Not Applicable ND = No Data NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association
IARC = International Agency for Research on Cancer NTP = National Toxicology Program
NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration
NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System
NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Feeds to the B/B Extractor and B/B Settler

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0061
Revision Date 05/27/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquefied Gas.		
Color	Colorless liquid, invisible gas and vapor; white frost at release point.	Odor	Strong, unpleasant, and distinctive of skunk or rotten cabbage.

DANGER! Extremely flammable liquefied gas; vapor may cause flash fire or explosion!
 May form explosive peroxides on exposure to air!
 High pressure and rapid diffusion hazard!
 Liquid or compressed gas contact may cause frostbite or freeze burns!
 May be harmful or fatal if inhaled or absorbed through the skin!
 High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation!
 Vapor or mist may cause mild to severe eye, mucous membrane, and respiratory tract irritation and inflammation!
 Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
 Overexposures may cause target organ effects such as lung, brain, central nervous system, heart, blood, liver, and/or kidney damage!
 Contains low levels of 1,3-Butadiene! Based upon laboratory animal tests, cancer, mutagenic, and reproductive hazards might exist!
 May cause blood system disorders and/or genetic damage!
 May adversely affect reproduction or reproductive development!

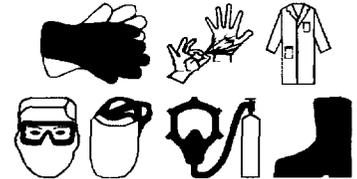
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Feeds to the B/B Extractor and B/B Settler	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110061	Medical Emergency	(918) 495-4700
CAS Number	Mixture (See Section 2)	CHEMTREC Emergency	(800) 424-9300
Product Family	Liquefied Gas Mixture of Partially Treated Thermal and Catalytic Cracked C4 Hydrocarbon Streams		
Synonyms	Partially-treated C4-Rich Liquefied Petroleum Gases, Unsweetened Butanes/Butenes Mixture; Unsweetened B/B Stock, Unsweetened C4-Rich Gases, Unsweetened Technical-grade Butene; BRU V-101 and V-102 Caustic Treater Effluent; LPG Blend containing Mercaptans; C3-C5 Hydrocarbons and R-SHs.		

Feeds to the B/B Extractor and B/B Settler

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Liquefied Petroleum Gases	68476-85-7	100
2) C4-Rich Gases	68477-85-0	99-100
3) Butenes or Butylenes	25167-67-3	40-60
4) Iso-Butane	75-28-5	25-40
5) Isobutylene	115-11-7	5-20
6) n-Butane	106-97-8	5-15
7) Iso-Pentane	78-78-4	1-5
8) Propane	74-98-6	0-3
9) Propylene	115-07-1	0-2
10) n-Pentane	109-66-0	0-2
11) 1,3-Butadiene	106-99-0	0.1-1
12) Methyl mercaptan	74-93-1	0-0.5
13) Ethyl mercaptan	75-08-1	0-0.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact. Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 150 ppm or more of methyl mercaptan are immediately dangerous to life and health. At concentrations above 700 ppm, it may cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)</p> <p>Additionally, at least one component of this liquefied gas mixture is a "simple asphyxiant". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.</p>
Eye Contact	Vapors may cause mild to severe eye irritation upon short-term exposure. Severity depends upon the concentration of mercaptans and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with an expanding liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Methyl mercaptan can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus.
Chronic Health Effects Summary	<p>Chronic inhalation to components of this mixture (propane, propene, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.</p> <p>1,3-Butadiene (BD), a minor component of this stream, has been shown to be mutagenic and produces multiple organ tumors in various tissues of laboratory rodents. BD also causes sexual organ atrophy in test animals. (See Section 11.)</p>
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture. They should take additional precautions to minimize or avoid exposure.
Target Organs	These streams are toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, and possibly, the liver, kidneys, bladder, and reproductive systems.

Feeds to the B/B Extractor and B/B Settler

Carcinogenic Potential These refinery streams contain 1,3-butadiene at concentrations above 0.1%. 1,3-Butadiene is considered carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910 1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Liquefied Gas.		
Flash Point/Method	CLOSED CUP: AP -107° to -73°C (-160° to -100°F). (Estimated)		
Lower Flammable Limit	AP 1.6 %	Upper Flammable Limit	AP 21.8 %
Auto-Ignition Temp.	AP 288°C (550°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans		

Feeds to the B/B Extractor and B/B Settler

Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling **Danger! Poisonous and Flammable Gas!** Do NOT breathe vapor, it may contain mercaptans and/or simple asphyxiants. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

Feeds to the B/B Extractor and B/B Settler

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 and wear appropriate personal protective clothing/equipment. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposures, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable liquefied gases. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against mercaptans and simple asphyxiants.

Feeds to the B/B Extractor and B/B Settler

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Methyl mercaptan	TWA: 5 (ppm) from ACGIH (TLV) [1997] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998]
2) Ethyl mercaptan	TWA: 0.5 CEIL: 10 (ppm) from OSHA [1989] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998]
3) Liquefied Petroleum Gases	TWA: 0.5 CEIL: 10 (ppm) from OSHA (PEL) [1989] TWA: 1000 (ppm) from ACGIH (TLV) [1998]
4) Propylene	TWA: 1000 (ppm) from OSHA (PEL) [1989]
5) Propane	Simple asphyxiant TWA: 2500 (ppm) from ACGIH (TLV) [1998]
6) Butanes	TWA: 1000 (ppm) from OSHA (PEL) [1989] TWA: 800 (ppm) from ACGIH (TLV) [1998]
7) 1,3-Butadiene ("A2" and "Z-2" Carcinogen)	TWA: 800 (ppm) from OSHA (PEL) [1989] TWA: 2 (ppm) from ACGIH (TLV) [1998]
8) Pentanes	TWA: 2 STEL: 5 AL: 1 (ppm) from OSHA (PEL) [1994] TWA: 600 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1976]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas	Color	Colorless liquid; invisible gas and vapor, white frost at release point	Odor	Strong, unpleasant, and distinctive of skunk or rotten cabbage.
Specific Gravity	AP 0.58 to 0.61 (Water = 1)	pH	Not applicable.	Vapor Density	AP 1.9 to 2.1 (Air = 1)
Boiling Point/Range	AP -48°C to 36°C (-54° to 97°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			AP -160° to -101°C (-255° to -150°F) at 14.7 psia
Vapor Pressure	50 to 75 psia at 100°F	Viscosity (cSt @ 40°C)			Not applicable.
Solubility in Water	Moderately soluble in cold water	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 20,600 to 21,100 Btu/lb or 3,250 Btu/cu ft ; Dry Point Temperature = AP 95°F (35°C) (ASTM D-86); Average Density at 60°F = AP 5.00 lbs./gal (ASTM D-2161).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS		

Feeds to the B/B Extractor and B/B Settler

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Methanethiol (Methyl mercaptan):

GAS (LC50): Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration
GAS (LC50): Acute: 6,530 ug/m³ for 2 hours [Mouse]

Ethanethiol (Ethyl mercaptan):

GAS (LC50): Acute: 2,770 ppm for 4 hours [Mouse] - Excitment, motor activity changes, and cyanosis.
GAS (LC50): Acute: 4,420 ppm for 4 hours [Rat] - Excitment, spastic parapysis, and cyanosis
ORAL (LD50): Acute: 682 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis
INTRAPERITONEAL (LD50): Acute 226 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.

Propylene

GAS (LC50): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse].
GAS (TCLo): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.

Iso-Butane:

GAS (TCLo): Acute 1,040,000 mg/m³ for 2 hours [Mouse] - Excitment
GAS (LC50) Acute. 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.

Iso-Butene (Isobutylene or 2-Methylpropene).

GAS (LC50) Acute: 415,000 mg/m³ for 2 hours [Mouse]
GAS (LC50): Acute: 620,000 mg/m³ for 4 hours [Rat].

n-Butane:

GAS (LC50): Acute: 660,000 mg/m³ for 4 hours [Rat].
GAS (LC50): Acute: 680,000 mg/m³ for 2 hours [Mouse]

1,3-Butadiene (Erythrene or Pyrrolyene).

GAS (LC50): Acute: 285,000 mg/m³ for 4 hour(s) [Rat].
GAS (LC50): Acute: 270,000 mg/m³ for 2 hours [Mouse].
ORAL (LD50) Acute: 5,480 mg/kg [Rat].

n-Pentane:

GAS (LC50): Acute: 364,000 mg/m³ for 4 hour(s) [Rat] - Excitment
INTRAVENOUS (LD50): Acute: 446 mg/kg [Mouse]

Methyl and ethyl mercaptans act as respiratory poisons by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, they can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They are also eye irritants and have been shown to produce positive responses in various mutagenic assays

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinepherine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinepherine (adrenaline). **Propylene** has also been found to be a cardiac sensitizer in dogs. An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause redding of the eyelids and face, tearing, coughing, and sometimes flexng of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications

Propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice, however, it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane** and **n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

Feeds to the B/B Extractor and B/B Settler

At very high concentrations, **1,3-butadiene (BD)** produces narcosis with central nervous system depression and/or respiratory paralysis. Lifetime inhalation studies have shown BD or its epoxide metabolites cause multiple organ tumors in various tissues of both rats and mice. It is also a mutagen and causes sexual organ atrophy in test animals. Epidemiology studies amongst BD workers and styrene-butadiene rubber (SBR) workers suggest that BD or BD epoxide metabolite exposures may increase the risk of cancers of the lymphohematopoietic system. Based on these various studies, IARC, NTP, OSHA, ACGIH, and EPA have determined BD to be an animal carcinogen and a probable human carcinogen. Laboratory animals have exhibited a higher degree of narcosis when exposed to combinations of butane, butenes, and 1,3-butadiene (additive effect), than the degree of narcosis exhibited following exposure to each gas alone.

Inhalation of 500 ppm of **isopentane** or **n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane** and **n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **propane, propylene, butenes, and the mercaptan** components of these streams may contribute to generation of atmospheric smog. The atmospheric half-lives of **propane, propylene, and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours; and, **1,3-butadiene's** half-life is only 2 to 3 hours. Experimental data shows that significant photooxidation of **propylene and 1,3-butadiene** occurs rapidly within 7 to 21 hours. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. The **pentanes** have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Photooxidation of **propane, isobutane, and n-butane** in air (LT 8%) are not considered to be environmentally significant.

Environmental Fate

Liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%), however, the toxic **methyl and ethyl mercaptan** components are moderately soluble in water. Therefore, this material could potentially cause harm to aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Feeds to the B/B Extractor
and B/B Settler**

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s Inhalation Hazard Zone B (Methyl mercaptan)		
Hazard Class	Class 2.3: Poisonous gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance component present in this material which might require DOT HAZMAT bill-of-lading display is Methyl mercaptan .		
Placards	 	Emergency Response Guide No.	119
		HAZMAT STCC No.	49 203 78
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance which might be present in these streams and is subject to this statute is: Methanethiol (Methyl mercaptan) [CAS No. 74-93-1]
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2 This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	These streams contain the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Propylene or Propene [CAS No. 115-07-1] concentration: 0 to 2% 1,3-Butadiene [CAS No. 106-99-0] concentration: 0.1 to 1%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4 A chemical substance that might be present in these streams which is subject to this statute is: Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 0.5%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA) Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802
California Proposition 65	These streams contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5 1,3-Butadiene [CAS No. 106-99-0].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in these streams as "Volatile Organic Compounds (VOC)" that contribute significantly to air pollution which endangers public health and welfare": Propylene (Propene), 1,3-Butadiene, 1-Butene, Isobutylene, Isopentane, 1-Pentene, and n-Pentane.

Feeds to the B/B Extractor and B/B Settler

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in these streams that are subject to this statute are: **Methyl mercaptan (Methanethiol), Ethyl mercaptan (Ethanethiol), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, n-Butane, 1,3-Butadiene, Isopentane (Butane, 2-methyl), 2,2-Dimethylpropane (Neopentane), various Pentenes, and n-Pentane**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1 0
Revision Date 05/27/1999
Print Date Printed on 06/04/1999.

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists			AIHA = American Industrial Hygiene Association			
IARC = International Agency for Research on Cancer			NTP = National Toxicology Program			
NIOSH = National Institute of Occupational Safety and Health			OSHA = Occupational Safety and Health Administration			
NPCA = National Paint and Coating Manufacturers Association			HMIS = Hazardous Materials Information System			
NFPA = National Fire Protection Association			EPA = Environmental Protection Agency			

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Feeds to the P/P Caustic Treater and Wash Drum

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0062
Revision Date 05/28/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquefied Gas.		
Color	Colorless liquid, invisible gas and vapor, white frost at release point	Odor	Strong, unpleasant, and distinctive of rotten cabbage.

DANGER! Extremely flammable compressed liquefied gas;
vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
Liquid or compressed gas contact may cause frostbite or freeze burns!
May be harmful or fatal if inhaled or absorbed through the skin!
High concentrations of vapor reduce oxygen available for breathing and
may cause central nervous system (CNS) depression or suffocation!
Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats)!
Overexposures may cause target organ effects such as lung, heart,
central nervous system, blood, liver, and/or kidney damage!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Feeds to the P/P Caustic Treater and Wash Drum	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110062	Medical Emergency	(918) 495-4700
CAS Number	Mixture (See Section 2.)	CHEMTREC Emergency	(800) 424-9300
Product Family	Liquefied Gas Mixture of Thermal and Catalytic Cracked C3 Hydrocarbon Streams		
Synonyms	Unsweetened Propylene/Propane Mixture; Unsweetened P/P Stock, Unsweetened C3-Rich Gases, Unsweetened Technical-grade Propylene; Partially-refined C3-Rich Liquefied Petroleum Gases; C3-Rich Catalytically and Thermally Cracked Gases; P/P Treater Feeds, FCCU (732) Depropanizer Scrubber Overhead Stream, 736 and 737 Coker Units Propane/Propylene Scrubber Overhead Streams, LPG Blend containing Mercaptans, C3-C4 Hydrocarbons and R-SHs.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) C3-C4 Hydrocarbons, C3-Rich, Cracked and Distilled (Petroleum)	68131-75-9	100
2) Liquefied Petroleum Gases	68476-85-7	100
3) Propylene	115-07-1	55-78
4) Propane	000074-98-6	20-40
5) Iso-Butane	75-28-5	1-5
6) Butenes or Butylenes	25167-67-3	0.5-1.5
7) Ethane	74-84-0	0-1.5
8) Methyl mercaptan	74-93-1	0.1-1

Feeds to the P/P Caustic Treater and Wash Drum

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled! Inhalation of the pressurized gas may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 150 ppm or more of methyl mercaptan are immediately dangerous to life and health At concentrations above 700 ppm, it may cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11)
	Additionally, several components of this liquefied gas mixture are "simple asphyxiants" (See Section 8). High concentrations of this material can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia) Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure Oxygen deprivation is possible if working in confined spaces
Eye Contact	Vapors may cause mild to severe eye irritation upon short-term exposure. Severity depends upon the concentration of mercaptans and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with an expanding liquefied/pressurized gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Methyl mercaptan can be absorbed through the skin to produce toxic effects If the skin is damaged, absorption increases.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas mixture. However, if swallowed, this material may "freeze burn" the mucous membranes of the mouth, throat, and esophagus
Chronic Health Effects Summary	Chronic inhalation of this material's components (propane and propylene) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline) -like drugs.
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, high blood pressure, cardiovascular conditions, or skin disorders should avoid exposure Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this liquefied gas mixture They should take additional precautions to minimize or avoid exposure
Target Organs	These streams are toxic to eyes, skin, mucous membranes, lungs, central nervous system, brain, heart, blood, and possibly, the liver and kidneys.
Carcinogenic Potential	These refinery streams do not contain any components at concentrations at or above 0.1% which are considered carcinogenic by OSHA, IARC, and NTP

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910 1200)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Feeds to the P/P Caustic Treater and Wash Drum

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Liquefied Gas		
Flash Point/Method	CLOSED CUP: AP -107° to -83°C (-160° to -118°F). (Estimated)		
Lower Flammable Limit	AP 2.0 %	Upper Flammable Limit	AP 21.8 %
Auto-ignition Temp.	AP 450°C (842°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans		
Special Properties	This liquefied gas is extremely flammable at well below ambient temperatures and readily forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		

Feeds to the P/P Caustic Treater and Wash Drum

Fire Fighting Protective Clothing

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it contains methyl mercaptan and simple asphyxiants. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 and wear appropriate personal protective clothing/equipment. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Feeds to the P/P Caustic Treater and Wash Drum

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposures, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable liquefied gases. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Odor is not an adequate warning for potentially hazardous air concentrations! Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against methyl mercaptan and simple asphyxiants.

Feeds to the P/P Caustic Treater and Wash Drum

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Methyl mercaptan	TWA: 5 (ppm) from ACGIH (TLV) [1997] TWA: 0.5 (ppm) from ACGIH (TLV) [proposed for 1998] TWA: 0.5 CEIL: 10 (ppm) from OSHA [1989]
2) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
3) Ethane	Simple asphyxiant.
4) Propylene	Simple asphyxiant.
5) Propane	TWA: 2500 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
6) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1998] TWA: 800 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas.	Color	Colorless liquid; invisible gas and vapor; white frost at release.	Odor	Strong, unpleasant, and distinctive of rotten cabbage.
Specific Gravity	AP 0.51 to 0.52 (Water = 1)	pH	Not applicable.	Vapor Density	AP 1.45 to 1.5 (Air = 1)
Boiling Point/Range	AP -88°C to 5°C (-127° to 42°F) at 14.7 psia (ASTM D-2887)	Melting/Freezing Point			AP -187° to -160°C (-305° to -255°F) at 14.7 psia
Vapor Pressure	190 to 205 psia at 40°C (104°F)	Viscosity (cSt @ 40°C)			Not applicable.
Solubility in Water	Moderately soluble in cold water	Volatile Characteristics			This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Gross Heat of Combustion at 60°F = AP 21,500 Btu/lb or 2,550 Btu/cu.ft.; Dry Point Temperature = AP 11°F (-12°C) (ASTM D-86).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Methanethiol (Methyl mercaptan): GAS (LC50): Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration. GAS (LC50): Acute: 6,530 ug/m³ for 2 hours [Mouse].</p> <p>Propylene: GAS (LC50): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse]. GAS (TCLo) Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response</p> <p>Iso-Butane: GAS (TCLo): Acute: 1,040,000 mg/m³ for 2 hours [Mouse] - Excitement. GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p> <p>Iso-Butene (isobutylene or 2-Methylpropene): GAS (LC50): Acute: 415,000 mg/m³ for 2 hours [Mouse]. GAS (LC50): Acute: 620,000 mg/m³ for 4 hours [Rat].</p>
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Feeds to the P/P Caustic Treater and Wash Drum

Methyl mercaptan acts as respiratory poison by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, it can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. It is also an eye irritant and has been shown to produce positive responses in various mutagenic assays.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). **Propylene** has also been found to be a cardiac sensitizer in dogs.

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Propylene was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice, however, it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane** in air for periods of 8 hours daily for 10 days. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **ethane, propane, propylene, butenes, and methyl mercaptan** components of these streams may contribute to generation of atmospheric smog. The atmospheric half-lives of **ethane, propane, propylene, and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours. Experimental data shows that significant photooxidation of **propylene** occurs rapidly within 7 to 21 hours. Photooxidation of **ethane, propane, isobutane, and n-butane** in air (LT 8%) are not considered to be environmentally significant.

Environmental Fate

Liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%); however, the toxic **methyl mercaptan** component is moderately soluble in water. Therefore, this material could potentially cause harm to aquatic life.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

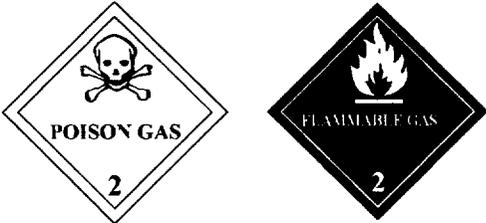
Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste for additional reasons, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

Feeds to the P/P Caustic Treater and Wash Drum

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this liquefied gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Methyl mercaptan)		
Hazard Class	Class 2.3: Poisonous gas	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance component present in this material which might require DOT HAZMAT bill-of-lading display is Methyl mercaptan .		
Placards			Emergency Response Guide No. 119 HAZMAT STCC No. 49 203 78 MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	These streams and/or their components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance which might be present in these streams and is subject to this statute is: Methanethiol (Methyl mercaptan) [CAS No. 74-93-1]
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	These streams contain the following component in concentrations which are above de minimis levels and it is listed as a toxic chemical in 40 CFR Part 372 pursuant to the requirements of Section 313: Propylene or Propene [CAS No. 115-07-1] concentration: 55 to 78%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance that might be present in these streams which is subject to this statute is: Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 1%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	These streams do not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, they are not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2

Feeds to the P/P Caustic Treater and Wash Drum

Additional Regulatory Remarks

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in these streams as "Volatile Organic Compounds (VOC)" that contribute significantly to air pollution which endangers public health and welfare": **Propylene (Propene), 1-Butene, and Isobutylene.**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in these streams that are subject to this statute are: **Methyl mercaptan (Methanethiol), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), and various Butenes.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 05/28/1999
Print Date Printed on 06/08/1999

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Depentanizer Tower Overhead Gases

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0063
Revision Date 10/12/2000

Hazard Rankings		
	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview			
Physical State	Gas/Liquefied Gas.		
Color	Colorless liquid, invisible vapor	Odor	Odorless to a strong, foul smelling, rotten egg odor which is unreliable as a warning of possible exposure
<p>DANGER! Extremely flammable and potentially poisonous gas/liquid; vapor may cause flash fire or explosion! High pressure and rapid diffusion hazard! Compressed gas or liquid contact may cause frostbite or freeze burns! High concentrations of vapor reduce oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation! Contains low levels of hydrogen sulfide (H₂S)! May be harmful or fatal if inhaled! Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)! Overexposures may cause target organ effects! Mist or vapor may cause mild to severe eye, skin, mucous membrane, and respiratory tract irritation and inflammation! May be harmful if absorbed through the skin! Based upon laboratory animal tests, reproductive hazards might exist!</p>			

Protective Equipment
<p>Minimum Requirements See Section 8 for Details</p>

SECTION 1: IDENTIFICATION

Trade Name	Depentanizer Tower Overhead Gases	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068478057*	Medical Emergency	(337) 708-6215 or (918) 495-4700
CAS Number	68478-05-7	CHEMTREC Emergency	(800) 424-9300
Product Family	Alkane and Alkene Hydrocarbons, Hydrogen, and Hydrogen Sulfide		
Synonyms	534 Depentanizer Overhead Gas, Untreated High-pressure Gas from the 534 Unit Depentanizer Tower; Coker Naphtha Depentanizer Tower Overhead Gases; Delayed Coker Naphtha Splitter Overhead Gas, Thermal Cracking Distillation Gases (Petroleum), Thermocracker Depentanizer Overhead Gas, Sour Light Gas Mixture, C1-C6 Hydrocarbons, Hydrogen, and Hydrogen Sulfide		

Depentanizer Tower Overhead Gases

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Thermal Cracking Distillation Gases (Petroleum)	68478-05-7	100
2) Hydrogen sulfide	7783-06-4	0.3-0.5
3) Nitrogen	7727-37-9	0-1.6
4) Carbon monoxide	630-08-0	0-1.5
5) Carbon dioxide	124-38-9	0-1-1.5
6) Hydrogen	1333-74-0	1-10
7) Methane	74-82-8	1-15
8) Ethane	74-84-0	5-20
9) Propane	74-98-6	10-30
10) Iso-Butane	75-28-5	5-20
11) Butenes or Butylenes	25167-67-3	0-2
12) n-Butane	106-97-8	15-40
13) Iso-Pentane	78-78-4	1-10
14) Pentenes or Pentylenes	68527-11-7	0-2
15) n-Pentane	109-66-0	5-15
16) Hexane Isomers	Mixture	0-5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation Eye contact Skin contact Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)</p> <p>Additionally, several components of this gas/liquid mixture are "simple asphyxiants." High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.</p>
Eye Contact	Vapors may cause moderate to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and duration of exposure. Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Direct contact with an expanding gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Hydrogen sulfide can be absorbed through the skin to produce toxic effects.
Ingestion	Ingestion is not an applicable route of exposure for gases. However, if the condensate portion of this material is ingested, there is a danger of aspiration into the lungs if vomiting occurs. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.</p> <p>Chronic inhalation of some of this gas' components (propane, propylene, n-butane, and n-pentane) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs.</p>

Depentanizer Tower Overhead Gases

Long-term exposure to airborne **carbon dioxide** concentrations as low as 0.5 to 1% can alter the body's acid-base and calcium-phosphorus balance, resulting in metabolic acidosis and increased calcium deposits in soft tissues. Chronic exposure to levels of 1 to 2% CO₂ in air can stress the adrenal cortex because of constant respiratory stimulation, this level of exposure may be considered dangerous after several hours. CO₂ might also be a threat to the well-being of the unborn if a pregnant woman is exposed enough to cause metabolic acidosis.

Whether or not there is a chronic **CO** poisoning distinct from the acute effects is controversial. However, chronic CO exposure can aggravate angina pectoris in persons with coronary artery disease. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with eye, skin, cardiac, liver or kidney function, or neurological disorders, pre-existing chronic respiratory diseases, central nervous system (CNS) disease, and high blood pressure, or attempting to conceive should take additional precautions to minimize or avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of "simple asphyxiants". They should take additional precautions to minimize or avoid exposure.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

The substance is toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, brain, heart, blood, and possibly, the endocrine and reproductive systems.

Carcinogenic Potential

This product does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation

Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact

If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.

Skin Contact

The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.

Ingestion

Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Depentanizer Tower Overhead Gases

Notes to Physician

Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.

This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Flammable Gas/Liquefied Gas Extremely flammable ¹		
Flash Point Method	CLOSED CUP: AP -157° to -73°C (-250° to -100°F) (Estimated)		
Lower Flammable Limit	1.6 to 4.0 %	Upper Flammable Limit	45 to 75 %
Autoignition Temperature	AP 260°C (500°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur		
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. The hydrogen component of this gas is lighter than air and readily forms flammable mixtures with air. It will rise rapidly and collect in the upper portions of confined spaces. Exposed to an ignition source, it will burn with an invisible, blue-colored flame in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources ¹ .		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Depentanizer Tower Overhead Gases

Extremely Flammable Liquefied Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it contains **hydrogen sulfide (H₂S)**. This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N F P A's National Electrical Code (NEC). H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

Depentanizer Tower Overhead Gases

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, fixed or personal monitors can be used for detection and as an exposure monitoring system.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection Avoid skin contact and use gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).

General Comments For an explanation about some of the occupational exposure limits shown below, refer to the definition of "Simple Asphyxiant" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current **Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents** handbook. Releases of this liquefied gas mixture may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 20 Vol % in air). Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Odor is an inadequate warning for hazardous air concentrations. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [2000] TWA: 5 (ppm) from ACGIH (TLV) [Proposed for 2001] TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) [1989]
2) Carbon monoxide	TWA: 25 (ppm) from ACGIH (TLV) [2000] TWA: 35 CEIL: 200 (ppm) from OSHA (PEL) [1989] TWA: 50 (ppm) from OSHA (PEL) [1882]
3) Carbon dioxide	TWA: 5000 STEL: 30000 (ppm) from ACGIH (TLV) [2000] TWA: 5000 STEL: 30000 (ppm) from OSHA (PEL) [1989]
4) Nitrogen	Simple asphyxiant [2000]
5) Hydrogen	Simple asphyxiant [2000]
6) Methane	Simple asphyxiant [2000]
7) Ethane	Simple asphyxiant [2000].
8) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [2000] TWA: 1000 (ppm) from OSHA (PEL) [1989] TWA: 2500 (ppm) from ACGIH (TLV) [2000] TWA: 1000 (ppm) from OSHA (PEL) [1989]
9) Propane	

Depentanizer Tower Overhead Gases

10) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [2000] TWA: 800 (ppm) from OSHA (PEL) [1989]
11) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) [2000] TWA: 600 STEL 750 (ppm) from OSHA (PEL) [1989] TWA: 1000 (ppm) from OSHA (PEL) [1976]
12) Hexane, other isomers	TWA: 500 STEL 1000 (ppm) from ACGIH (TLV) [2000] TWA: 500 STEL 1000 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas	Color	Colorless liquid, invisible vapor	Odor	Odorless to a strong, foul smelling, rotten egg odor which is unreliable as a warning of possible exposure
Specific Gravity	AP 0.51 to 0.62 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to acidic H ₂ SO ₄ .	Vapor Density	1.0 to 1.4 (Air = 1)
Boiling Point/Range	-253° to 36°C (-423° to 97°F) (by ASTM D-2887)	Melting/Freezing Point			AP -260° to -82°C (-435° to -117°F) at 14.7 psia
Vapor Pressure	50 to 300 psia at 38°C (100°F) or GT 140 mm Hg at 20°C (68°F)	Viscosity (cSt @ 40°C)			Not applicable
Solubility in Water	Moderately soluble in cold water (>0.5%)	Volatile Characteristics			This material is usually stored as a liquefied gas mixture. If open to the atmosphere, it will evaporate quickly to form a vapor cloud
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard Alkane, Isoparaffin, and Alkene Hydrocarbons Content = 60 to 99 Wt.% (ASTM D-1319), Average Density at 60°F = 4.20 to 4.90 lbs./gal. (ASTM D-2161), Gross Heat of Combustion at 60°F = 20,000 to 21,000 Btu/lb or 2,500 to 3,500 Btu/cu ft				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Although unlikely, polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Hydrogen sulfide: GAS (TCLo): Acute 10 ppm for 15 minutes (Human) - Eye irritation. GAS (TCLo): Acute 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation GAS (LC100) Acute 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death GAS (LCLo). Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death</p> <p>Iso-Butane: GAS (TCLo). Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement. GAS (LC50) Acute 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p>
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Depentanizer Tower Overhead Gases

Iso-Butene (Isobutylene or 2-Methylpropene):

GAS (LC50) Acute 415 gm/m³ for 2 hours [Mouse]

GAS (LC50) Acute 620 gm/m³ for 4 hours [Rat]

n-Butane:

GAS (LC50) Acute 660 gm/m³ for 4 hour(s) [Rat]

GAS (LC50) Acute 680 gm/m³ for 2 hours [Mouse]

n-Pentane:

GAS (LC50): Acute: 364 gm/m³ for 4 hour(s) [Rat] - Excitement

INTRAVENOUS (LD50) Acute 446 mg/kg [Mouse]

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Carbon monoxide (CO) is extremely toxic with permanent effects from acute exposure. CO is toxic because it binds to hemoglobin in the blood, preventing oxygen binding, reducing blood transport capacity, and thus cellular respiration. Breathing CO at 5 to 30 ppm in air, or smoking one pack of cigarettes per day, increases the blood carboxyhemoglobin (COHb) level in an adult to between 1 and 5%. Exposure to ambient CO levels of 30 to 60 ppm in air, or smoking up to 3 packs of cigarettes per day, increases blood COHb to a range of 5 to 9%. At this COHb level, persons with coronary artery disease can develop chest pain upon moderate exertion. Binding of CO to hemoglobin is slowly reversible, with a half-life of approximately 5 to 7 hours while breathing room air.

Acute CO poisoning occurs frequently and is the most common cause of lethal poisonings in the U.S.A. and France (17.5 deaths per 100,000 population from fires, automobile exhaust, defective heaters and stoves, and improper use of charcoal briquettes). Also, almost every known neurological disorder has been associated with CO poisoning, including deafness, blindness, and Parkinsonism. Structural damage of the brain can be seen on the CAT scans of persons who survived high-level acute CO exposures. Neurological deterioration may be delayed following recovery. Acute CO exposure also affects the heart, producing damage to the myocardium, because it requires a high level of oxygenation.

Whether or not there is a chronic CO poisoning distinct from the acute effects is controversial. However, chronic CO exposure can aggravate angina pectoris in persons with coronary artery disease.

Many people have died from overexposure to **carbon dioxide (CO₂) gas**. CO₂ exerts direct toxicity on the heart, resulting in diminished contractile force. It is also a vasodilator, and is the most potent cerebrovascular dilator known. At an airborne concentration of 5,500 ppm for 6 hours, CO₂ has no ill effects, while at 3% (30,000 ppm) it is mildly narcotic and causes reduced hearing, increased blood pressure, and rapid pulse. Its IDLH has been determined to be 40,000 ppm (4%) in air. Concentrations of 50,000 to 80,000 ppm (5 to 8%) produce normal symptoms of hypoxia (see Section 3) within 10 minutes. And, at 8 to 10% in air, CO₂ causes tremors, hypertension, difficulty in breathing, and loss of consciousness within 5 to 10 minutes. Extended exposure to concentrations between 10 and 15% can be lethal. Breathing 20% CO₂ in air for 1 minute causes convulsions, unconsciousness, and usually death.

Long-term exposure to airborne **carbon dioxide** concentrations as low as 0.5 to 1%, while being generally well tolerated, can alter the body's acid-base and calcium-phosphorus balance, resulting in metabolic acidosis and increased calcium deposits in soft tissues. Chronic exposure to levels of 1 to 2% CO₂ in air can stress the adrenal cortex because of constant respiratory stimulation, if not given a period of gradual adaptation, this level of exposure is considered dangerous after several hours. CO₂ might also be a threat to the well-being of the unborn if a pregnant woman is exposed enough to cause metabolic acidosis. This decreases the blood supply to the uterus which increases fetal breathing movements and reduces fetal development. Also, laboratory rat studies suggest that CO₂ exposures may adversely affect male reproduction by altering the testes causing premature release of sperm and reduced fertility.

Depentanizer Tower Overhead Gases

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol % in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects, however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage, however, at ambient temperatures and pressure, the **butenes, pentenes, and hydrogen sulfide** components of this material may contribute to generation of atmospheric smog.

The atmospheric half-lives of **ethane, propane, and butanes** under photochemical smog conditions are estimated to be between 5 to 8 hours. Experimental data shows that significant photooxidation of ethylene and propylene occurs rapidly within 7 to 21 hours. Photooxidation of **hydrogen, methane, ethane, propane, isobutane, and n-butane** in air (LT 8%) are not considered environmentally significant. The **n-pentane, pentane isomers, n-hexane, and hexane isomers** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. **Hydrogen sulfide** residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.

Environmental Fate

Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%); and therefore, this material will not cause harm to aquatic life. However, the liquefied condensate portion of this mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water and evaporate rapidly. In cold stagnant or slow-flowing waterways, a hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

Depentanizer Tower Overhead Gases

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14: TRANSPORT INFORMATION

DOT Status This material is regulated by the U S Department of Transportation (DOT)

Proper Shipping Name Liquefied gas, flammable, toxic, n o s Inhalation Hazard Zone B (Hydrogen sulfide)

Hazard Class Class 2.3 Poisonous gas

Packing Group(s) Not applicable

UN/NA ID UN1953

Reportable Quantity A Reportable Quantity (RQ) substance component present in this material which might require DOT HAZMAT bill-of-lading display is **Hydrogen sulfide**. (See Section 15.)

Placards



Emergency Response Guide No. 119

HAZMAT STCC No. 49 057 66

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory

SARA 302/304 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance present in this material which is subject to this statute is **Hydrogen sulfide [CAS No. 7783-06-4] concentration: 0.3 to 0.5 Wt.%**

SARA 311/312 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories
Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.

SARA 313 This material does not contain any components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313

CERCLA The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance present in this material subject to this statute is
Hydrogen sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.3 to 0.5%.

CWA This material might be classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802

Depentanizer Tower Overhead Gases

**California
Proposition 65**

This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5

**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2.

**Additional Regulatory
Remarks**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution and endanger public health and welfare: **Ethylene (Ethene) [CAS No. 74-85-1], Propylene (Propene) [CAS No. 115-07-1], 1-Butene [CAS No. 106-98-9], Isobutylene [CAS No. 115-11-7], Isopentane [CAS No. 78-78-4], 1-Pentene [CAS No. 109-67-1], and n-Pentane [CAS No. 109-66-0].**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Hydrogen, Methane, Ethane, Ethylene (Ethene), Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, Butane, Isopentane (Butane, 2-methyl), various Pentenes, Pentane, and Hydrogen Sulfide.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1 0
Revision Date 10/12/2000
Print Date Printed on 10/19/2000

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0066
HFR# 440

Stripper Overhead

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0066
Revision Date 9/6/2006

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Biphasic liquid/gas.
Color Light amber to amber **Odor** Rotten Egg Hydrocarbon. (Strong.)

DANGER!

Extremely Flammable.

Contains Hydrogen Sulfide Gas.

Vapor may cause flash fire or explosion.

Vapor may travel considerable distance to source of ignition and flash back.

Harmful or fatal if swallowed - Can enter lungs and cause damage.

Repeated or excessive exposure to certain components of this mixture have been associated with central nervous system effects.

Harmful to aquatic organisms.

Possible Cancer Hazard (See Section 3)

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	4
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Stripper OH (Stream 35)	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	Mixture	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable.		
Synonyms	None		

SECTION 2. COMPOSITION (TYPICAL)

This product may be composed, in whole or in part, of any of the following refinery streams:

Heavy Hydrodesulfurized Naphtha, [CAS No. 64742-82-1]

Light Hydrodesulfurized Naphtha, [CAS No. 64742-73-0]

This product contains the following chemicals as components of the refinery streams listed above, with all liquid components being listed on a weight % basis and all gases on a mole % basis:

Component Name(s)	CAS Registry No.	Concentration (%)
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Stripper Overhead

Water	7732-18-5	20 - 30
C10-C11 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	10 - 30
Toluene	108-88-3	10 - 20
Iso-Pentane	78-78-4	9 - 19.4
Methane	74-82-8	10 - 15
Hydrogen sulfide	7783-06-4	10 - 15
Pentanes, all isomers	Mixture	5 - 20
Hydrogen	1333-74-0	10 - 15
Cumene	98-82-8	8 - 12
Ethane	74-84-0	5 - 10
Nonane, all isomers	Mixture	3 - 10
Heptane, all isomers	142-82-5	1 - 10
Hexene Isomers	Mixture	1 - 10
Xylene, all isomers	1330-20-7	0 - 10
Ethylbenzene	100-41-4	0 - 8
Propane	74-98-6	1 - 5
n-Hexane	110-54-3	1 - 5
Cyclohexane	110-82-7	1 - 5
Pentenes or Pentylenes	68527-11-7	1 - 5
Octanes, all isomers	Mixture	0 - 5
Benzene	71-43-2	1 - 3
n-Pentane	109-66-0	0.3 - 2
Methylcyclohexane	108-87-2	0 - 2

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness.
Eye Contact	This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.
Skin Contact	May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.
Ingestion	Swallowing this material may be harmful. Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea. This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).

Chronic Health Effects Summary Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea. Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers. Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor

Stripper Overhead

function and paralysis.

This material, or a component of this material, has been shown to cause cancer in laboratory animals. However it is not likely to represent a human cancer hazard.

See Toxicological Information (Section 11)

Conditions Aggravated by Exposure Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Peripheral Nervous System, Central Nervous System (CNS), Heart (Cardiac)

Target Organs Contains material which may cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, , bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

Carcinogenic Potential **CARCINOGENIC EFFECTS** Classified 2B (Possible for human.) by IARC [Ethylbenzene]. Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact Flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. If easily accomplished, check for and remove contact lenses. If contact lenses cannot be removed, seek immediate medical attention. Do not use eye ointment. Seek medical attention.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

Stripper Overhead

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA flammable liquid.	
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)	
Lower Flammable Limit	AP 1 %	Upper Flammable Limit AP 7 %
Autoignition Temperature	not available	
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.	
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.	
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.	
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities of potential fire and explosion hazard if liquid enter sewers or waterways.	

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or

Stripper Overhead

disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all applicable local, state and federal laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Do NOT use compressed air for filling, discharging or other handling operations.

Product container is not designed for elevated pressure. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Do not expose product containers to flames, sparks, heat or other potential ignition sources. Empty containers may contain product residues that can ignite with explosive force. Observe label precautions. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C). All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable regulatory requirements and the National Electrical Code.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Stripper Overhead

- Eye Protection** Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. A suitable emergency eye wash water and safety shower should be located near the work station.
- Hand Protection** Avoid skin contact. Use heavy duty gloves constructed of chemical resistant materials such as Viton® or heavy nitrile rubber. Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.
- Body Protection** Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Toluene	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Iso-Pentane	Not available.
Methane	Simple asphyxiant.
Hydrogen sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s). OSHA (United States). TWA: 1000 ppm 8 hour(s). Simple asphyxiant.
Hydrogen Cumene	ACGIH (United States). TWA: 50 ppm 8 hour(s). OSHA (United States). Skin TWA: 50 ppm 8 hour(s). Simple asphyxiant.
Ethane	Simple asphyxiant.
Nonane, all isomers	ACGIH (United States). TWA: 200 ppm 8 hour(s).
Heptane, all isomers	ACGIH (United States). TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s). OSHA (United States). TWA: 500 ppm 8 hour(s). Not available.
Hexene Isomers	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s).
Xylene, all isomers	OSHA (United States). TWA: 100 ppm 8 hour(s).

Stripper Overhead

Ethylbenzene	TWA: 100 ppm 8 hour(s). ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). OSHA (United States).
Propane	TWA: 100 ppm 8 hour(s). ACGIH (United States). TWA: 2500 ppm 8 hour(s). OSHA (United States). TWA: 1000 ppm 8 hour(s).
n-Hexane	Simple asphyxiant. ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Cyclohexane	ACGIH (United States). TWA: 100 ppm 8 hour(s). OSHA (United States). TWA: 300 ppm 8 hour(s).
Pentenes or Pentylenes	Not available.
Octanes, all isomers	ACGIH (United States). TWA: 300 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Benzene	ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
n-Pentane	ACGIH (United States, 1998). TWA: 600 ppm OSHA (United States, 1976). TWA: 1000 ppm
Methylcyclohexane	ACGIH (United States). TWA: 400 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Light Aliphatic Naphthas, Sour (family)	Not available.
Liquefied Petroleum Gases	ACGIH (United States). TWA: 1000 ppm 8 hour(s). OSHA (United States). TWA: 1000 ppm 8 hour(s).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Biphasic liquid/gas.	Color	Light amber to amber	Odor	Rotten Egg Hydrocarbon. (Strong.)
Specific Gravity	Not available	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	Not available			Melting/Freezing Point	Not available.
Vapor Pressure	The highest known value is 53.3 kPa (400 mm Hg) (at 20°C) (n-Pentane). Weighted average: 4.04 kPa (30.3 mm Hg) (at 20°C)			Volatility	Not available
Solubility in Water	Very slightly soluble in cold water. (<0.1 % w/w)			Viscosity (cSt @ 40°C)	not available
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)				

Stripper Overhead

Additional Properties

No additional information.

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks and flame.		
Materials Incompatibility	Incompatible with strong acids, strong bases, and strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Iso-Pentane

ORAL LDLo: Subchronic: 10000 mg/kg [Rat].

Hydrogen sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse]. Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations above 100 ppm are

Stripper Overhead

immediately dangerous to life and health.

Pentanes, all isomers

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Cumene:

Effects from Acute Exposure:

Overexposure to cumene may cause upper respiratory tract irritation and severe CNS depression.

Effects from Prolonged or Repeated Exposure:

Studies in laboratory animals indicate evidence of adverse effects on the kidney and adrenal glands following high level exposure. The relevance of these findings to humans is not clear at this time.

Heptane, all isomers

n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 3,500 mg/kg [Rat].

DERMAL (LD₅₀), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD₅₀), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Propane

Stripper Overhead

Studies in laboratory animals indicate exposure to extremely high levels of propane (1 to 10 vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause permanent peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Co-exposure to methylethyl ketone or methyl isobutyl ketone increases the neurotoxic properties of n-hexane. In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Benzene

ORAL (LD50):	Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
INHALATION (LC50):	
(VAPOR):	Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

n-Pentane

n-Pentane was associated with cardiac sensitization in rabbits at a 100,000 ppm concentration in air within four hours of exposure.

Stripper Overhead

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	No data.
Environmental Fate	This product will normally float on water. Components will evaporate rapidly. This material may be harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. The octanol-water partition coefficient (log Kow) for this product is expected to be in the range of 2.1 to 5.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Hydrogen sulfide, CAS Number, 7783-06-4 Concentration: 12.5%
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard

Stripper Overhead

SARA 313 Toxic Chemical Notification and Release Reporting

This product contains the following components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:

Toluene [CAS No.: 108-88-3] Concentration: 15%
 Hydrogen sulfide [CAS No.: 7783-06-4] Concentration: 12.5%
 Cumene [CAS No.: 98-82-8] Concentration: 10%
 Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 5%
 Ethylbenzene [CAS No.: 100-41-4] Concentration: 4%
 n-Hexane [CAS No.: 110-54-3] Concentration: 3%
 Cyclohexane [CAS No.: 110-82-7] Concentration: 3%
 Benzene [CAS No.: 71-43-2] Concentration: 2%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:

Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: 15%
 Hydrogen sulfide [CAS No.: 7783-06-4] RQ = 100 lbs. (45.36 kg) Concentration: 12.5%
 Cumene [CAS No.: 98-82-8] RQ = 5000 lbs. (2268 kg) Concentration: 10%
 Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 5%
 Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: 4%
 n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: 3%
 Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lbs. (453.6 kg) Concentration: 3%
 Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: 2%

Clean Water Act (CWA)

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Toluene: 15%
 Ethylbenzene: 4%
 Benzene: 2%

New Jersey Right-to-Know Label

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

Additional Regulatory Remarks

No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
 Revision Date 9/6/2006
 Print Date Printed on 9/6/2006.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		

Stripper Overhead

NFPA: National Fire Protection Association

EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0067
HFR#441

Sour Vent Gas

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0067
Revision Date 9/26/2006

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Emergency Overview

Physical State Gas.

Color Colorless to light yellow. **Odor** Hydrocarbon. Rotten eggs. (Strong.)

DANGER!

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

**Contains Hydrogen Sulfide Gas!
Harmful to aquatic organisms.**

May contains known animal carcinogens.

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Vent Waste Sour Gas (C1-C6 Hydrocarbons)	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	68814-47-1	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Sour Gas		
Synonyms	Refinery Vent Waste Gas Mixture, Refinery Gas Mixture, Untreated Low-Pressure (Low-Line) Gas, Low-Line Gathering System Gas, Untreated Fuel Gas, C1-C6 Hydrocarbons with Hydrogen Sulfide, Stripper Vent Gas, Drier Vent Unit 631.		

Sour Vent Gas

SECTION 2. COMPOSITION (TYPICAL)

All liquid components are listed on a weight % basis while all gases are listed on a mole % basis.

Component Name(s)	CAS Registry No.	Concentration (%)
Methane	74-82-8	0 - 40
n-Butane	106-97-8	15 - 20
Hydrogen sulfide	7783-06-4	0.1 - 30
Hydrogen	1333-74-0	0 - 30
n-Pentane	109-66-0	10 - 15
Ethane	74-84-0	0 - 20
Toluene	108-88-3	1 - 15
Propane	74-98-6	5 - 10
Ethylene	74-85-1	2 - 5
Iso-Butane	75-28-5	1 - 5
Hexane, other isomers	Mixture	1 - 5
n-Hexane	110-54-3	1 - 3
Octanes, all isomers	Mixture	1 - 3
Pentanes, all isomers	Mixture	1 - 3
Ammonia	7664-41-7	1 - 2
Xylene, all isomers	1330-20-7	1 - 2
Propylene	115-07-1	1 - 2
Ethylbenzene	100-41-4	0.1 - 2
Butenes or Butylenes	25167-67-3	0.5 - 1.5
Methylcyclohexane	108-87-2	0 - 2
Cumene	98-82-8	0 - 1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled. Contains hydrogen sulfide. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 to 1000 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death.

Inhalation of gas or vapor may cause respiratory paralysis, severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath.

Additionally, one or more components of this gas mixture is a "simple asphyxiant". High concentrations of this gas can displace the amount of oxygen available to breathe below that level necessary to sustain life. Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, weakness, nausea, vomiting, loss of coordination, unconsciousness, and coma, depending upon the concentration level and duration of exposure.

Eye Contact

Vapors may cause eye irritation and light sensitivity. Severity depends upon the concentration and duration of exposure. High concentrations of hydrogen sulfide can cause chemical burns.

Skin Contact

Direct contact with an expanding gas may produce skin damage from frostbite or freeze burns. Skin absorption of hydrogen sulfide appears to be minimal in humans.

Ingestion

Ingestion is not an applicable route of exposure for gases.

Chronic Health Effects Summary

Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea.

Sour Vent Gas

Conditions Aggravated by Exposure Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Respiratory System, Central Nervous System (CNS), Heart (Cardiac)

Target Organs Contains material which may cause damage to the following organs: mucous membranes, heart, skin, central nervous system (CNS), eye, lens or cornea.

Carcinogenic Potential **CARCINOGENIC EFFECTS** Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input checked="" type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact If tissue is frozen, immediately seek medical attention. If tissue is not frozen, check for and remove contact lenses. Then, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure luke warm water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible. Do not use eye ointment unless directed by a physician.

Skin Contact In the event of frostbite or freeze burn, the affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water. Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.

Ingestion Due to the volatile nature of this material, ingestion is not a likely route of entry.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

Treat symptomatically.

Sour Vent Gas

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.
Flash Point	Not available.
Lower Flammable Limit	AP 1 %
Upper Flammable Limit	AP 13 %
Autoignition Temperature	The lowest known value is 430°C (806°F) (Butane, all isomers).
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

SECTION 7. HANDLING AND STORAGE

Sour Vent Gas

Handling

DANGER: Poisonous and Flammable Gas. Do NOT breathe vapor; it contains hydrogen sulfide (H₂S). This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow escaping material to contact eyes or skin. Wear appropriate respiratory protection, protective work clothing, eye and face protection when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. Empty containers may still contain flammable and poisonous residue.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

Store sample cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F (38° C). Protect from dampness, salt or corrosive chemicals.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may be required in work areas to prevent accumulation of mixtures of gas and air that may ignite with explosive force. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling sampling cylinders, pressurized containers and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use neoprene or PCV/nitrile gloves. When handling materials that can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves.

Sour Vent Gas

- Body Protection** Prevent potential skin contact with cold liquid or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Releases of this gas may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency, flammability and toxic gas levels. Odor is NOT adequate to warn of hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Methane	Simple asphyxiant.
n-Butane	ACGIH (United States). TWA: 800 ppm 8 hour(s).
Hydrogen sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Hydrogen	Simple asphyxiant.
n-Pentane	ACGIH (United States, 1998). TWA: 600 ppm OSHA (United States, 1976). TWA: 1000 ppm
Ethane	Simple asphyxiant.
Toluene	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Propane	ACGIH (United States). TWA: 2500 ppm 8 hour(s). OSHA (United States). TWA: 1000 ppm 8 hour(s). Simple asphyxiant.
Ethylene	Simple asphyxiant.
Iso-Butane	ACGIH (United States). TWA: 800 ppm 8 hour(s).
Hexane, other isomers	ACGIH TLV (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
Hexane, other isomers	ACGIH (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
n-Hexane	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Octanes, all isomers	ACGIH (United States). TWA: 300 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm 8 hour(s).

Sour Vent Gas

Ammonia
Xylene, all isomers

TWA: 1000 ppm 8 hour(s).
Not available.

ACGIH (United States).

TWA: 100 ppm 8 hour(s).
STEL: 150 ppm 15 minute(s).

OSHA (United States).

TWA: 100 ppm 8 hour(s).

Propylene
Ethylbenzene

Simple asphyxiant.

ACGIH (United States).

TWA: 100 ppm 8 hour(s).
STEL: 125 ppm 15 minute(s).

OSHA (United States).

TWA: 100 ppm 8 hour(s).

Butenes or Butylenes
Methylcyclohexane

Not available.

ACGIH (United States).

TWA: 400 ppm 8 hour(s).

OSHA (United States).

TWA: 500 ppm 8 hour(s).

Cumene

ACGIH (United States).

TWA: 50 ppm 8 hour(s).

OSHA (United States). Skin

TWA: 50 ppm 8 hour(s).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas.	Color	Colorless to light yellow.	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	Not available	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	Not available.			Melting/Freezing Point	Not available.
Vapor Pressure	Not applicable.			Volatility	Not available.
Solubility in Water	Partially soluble in cold water.			Viscosity (cSt @ 40°C)	not available
Flash Point	Not available.				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

Sour Vent Gas

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

n-Butane

INHALATION (LC50): Acute: 660000 mg/m³ 4 hour(s) [Rat]. 680000 mg/m³ 2 hour(s) [Mouse].

An n-butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Also, butane may decrease the myocardial threshold to epinephrine-induced arrhythmias.

Hydrogen sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse].

Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations above 100 ppm are immediately dangerous to life and health.

n-Pentane

n-Pentane was associated with cardiac sensitization in rabbits at a concentration of 100,000 ppm in air within four hours of exposure. Pentane can act as an anesthetic by inhalation. Mice exhibited signs of respiratory irritation and mild central nervous system effects at concentrations of 32,000 to 69,000 ppm for five minutes.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Propane

Studies in laboratory animals indicate exposure to extremely high levels of propane (1 to 10 vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Sour Vent Gas

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause permanent peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Co-exposure to methylethyl ketone or methyl isobutyl ketone increases the neurotoxic properties of n-hexane. In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.

Pentanes, all isomers

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 3,500 mg/kg [Rat].

DERMAL (LD₅₀), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD₅₀), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Sour Vent Gas

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material.
Environmental Fate	An environmental fate analysis has not been conducted on this specific product. Releases are expected to cause significant immediate impact but only localized non-persistent environmental damage.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Material residues may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. If possible and permissible, this material may be disposed of as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Hydrogen sulfide, CAS Number, 7783-06-4 Concentration: 15.05%
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Sudden Release of Pressure, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard

Sour Vent Gas**SARA 313 Toxic
Chemical Notification
and Release Reporting**

This product contains the following components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:

Hydrogen sulfide [CAS No.: 7783-06-4] Concentration: 15.1%
Toluene [CAS No.: 108-88-3] Concentration: 8%
n-Hexane [CAS No.: 110-54-3] Concentration: 2%
Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 1.5%
Propylene [CAS No.: 115-07-1] Concentration: 1.5%
Ethylbenzene [CAS No.: 100-41-4] Concentration: 1.1%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:

Hydrogen sulfide [CAS No.: 7783-06-4] RQ = 100 lbs. (45.36 kg) Concentration: 15.1%
Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: 8%
n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: 2%
Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 1.5%
Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: 1.1%
Cumene [CAS No.: 98-82-8] RQ = 5000 lbs. (2268 kg) Concentration: 0.5%

**Clean Water Act
(CWA)**

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

**California
Proposition 65**

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):
Toluene: 8%
Ethylbenzene: 1.05%

**New Jersey
Right-to-Know Label**

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

**Additional Regulatory
Remarks**

No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 9/26/2006
Print Date Printed on 9/26/2006.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

Sour Vent Gas

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

Sulfidic Caustic Solution

RS0071
HFR # 301

Material Safety Data Sheet

Formerly
AP1156

Company

Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

MSDS No. AP1156

Revision Date 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid.	Odor	Pungent phenolic or sulfurous-type.
Color	Slightly turbid, light green to light blue.		

DANGER! Highly Corrosive!

May cause severe burns, perforation, and irreversible tissue damage.

Eye and/or skin irritation or dermal sensitization may result from prolonged or repeated contact with dilute solutions.

Health effects may be delayed. Avoid contact. Wash skin thoroughly but gently with soap and water after contact. Launder or neutralize contaminated clothing and protective equipment before wearing.

May be harmful or fatal if inhaled or swallowed.

May cause severe respiratory tract and/or gastrointestinal tract ulceration.

Aspiration into the lungs can cause pulmonary edema and chemical pneumonia.

May be corrosive to some organic and metallic substances.

May react violently with acids, acidic solutions, some metallic powders, or halogenated materials.

Reactions may generate extremely flammable hydrogen (H₂).

Spills may create a slipping hazard.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 3	3
Fire Hazard	0	0
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name Sulfidic Caustic Solution

Product Number 0115601156

CAS Number Mixture—Section 2.

Product Family Alkaline or highly basic process water.

Synonyms Phenolic Caustic; Phenolate Caustic; Caustic Phenolate; Crude Sodium Phenolates and Xylenolates; Mixture of Substituted Phenolates in Sodium Hydroxide Caustic Solution; Aqueous NaOH Solution of Phenols; Dilute Sulfide/Sulfite/Sulfate/Phenolate Caustic Solution; Sodium Salts of Tar Acids in Caustic Solution; Spent Sodium Hydroxide Neutralizing Agent and Sodium Phenolates; Diluted Neutralizing Agent (Petroleum).

Business Contact

Product Safety 800-700-0946

24 Hour Emergency Contact

CHEMTREC 800-424-9300

CANUTEC-Canada 613-996-6666

LYONDELL 800-245-4532

Sulfidic Caustic Solution

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Sodium Salts of Phenols & Sulfur Compounds Residue from Gasoline Alkali Scrubbers	68988-99-8	100
2) Spent Sodium Hydroxide Neutralizing Agent (Petroleum)	64742-40-1	100
3) Water	7732-18-5	40-85
4) Sodium Hydroxide	1310-73-2	5-20
5) Sodium Phenolate	139-02-6	5-15
6) Sodium Xylenolates	95-65-8	1-10
7) p-Ethyl Phenolate	19277-91-9	1-10
8) Dialkyl & Di-Ph Disulfides from Naphtha Sweetening	68955-96-4	1-5
9) Sodium Chloride	7647-14-5	0.5-1.5
10) Sodium Sulfate	7757-82-6	0.5-1.5
11) Sodium Sulfite	7757-83-7	0.1-0.9
12) Sodium Bisulfite	7631-90-5	0.1-0.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye contact. Inhalation. Skin Absorption.

Signs and Symptoms of Acute Exposure

Inhalation	Inhalation is not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of mist or liquid droplets may cause respiratory tract irritation, mucous membrane tissue burns, and possibly, pulmonary edema and chemical pneumonia. (See Section 11.)
Eye Contact	Irritating and may injure eye tissue if not promptly removed. The severity of the effects depend on the concentration of the sodium hydroxide and how soon after exposure the eyes are washed.
Skin Contact	May be irritating or corrosive to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solution (0.04 wt.% caustic) to minutes with more concentrated solutions. Prolonged or repeated contact, even to dilute concentrations of sodium hydroxide solutions, may cause a high degree of permanent tissue destruction.
Ingestion	If swallowed, this material may cause severe pain, nausea, vomiting, and/or bloody diarrhea, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon caustic solution concentration, ulceration of the gastrointestinal tract may also occur. This material is toxic and may be fatal.
Chronic Health Effects Summary	Prolonged and/or repeated contact can defat the skin and may produce moderate to severe irritation and inflammation and/or alkali burns. Repeated exposure to mists or aerosols of sodium hydroxide can produce either obstructive airway disease or a tolerance to its respiratory irritant effects. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing eye, skin, or gastrointestinal disorders, liver or kidney dysfunction, and chronic respiratory or nervous system diseases should avoid exposure.
Target Organs	The substance is toxic to eyes, skin, mucous membranes, lungs, and possibly the blood, bone marrow, liver, kidneys, and/or central nervous system.
Carcinogenic Potential	This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

Sulfidic Caustic Solution

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification		
Irritant <input checked="" type="checkbox"/>	Toxic <input checked="" type="checkbox"/>	Combustible <input type="checkbox"/>	Explosive <input type="checkbox"/>	Pyrophoric <input type="checkbox"/>
Sensitizer <input checked="" type="checkbox"/>	Highly Toxic <input type="checkbox"/>	Flammable <input type="checkbox"/>	Oxidizer <input type="checkbox"/>	Water-reactive <input checked="" type="checkbox"/>
Corrosive <input checked="" type="checkbox"/>	Carcinogenic <input type="checkbox"/>	Compressed Gas <input type="checkbox"/>	Organic Peroxide <input type="checkbox"/>	Unstable <input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with water under a cool or cold shower for at least 15 minutes while removing contaminated shoes and clothing. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases, and groin area. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.
Notes to Physician	<p>If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a dilute solution of boric acid or acetic acid</p> <p>Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>Mucosal injury following ingestion may contraindicate the induction of vomiting. If gastric lavage is performed, intubation should be done with great care. In cases of severe esophageal tissue corrosion, the use of therapeutic doses of steroids should be considered. Also, the patient should receive general supportive measures with scrupulous monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Non-flammable liquid.		
Flash Point Method	Not applicable.		
Lower Flammable Limit	Not applicable.	Upper Flammable Limit	Not applicable.
Autoignition Temperature	Not applicable.		
Hazardous Combustion Products	Contact with some metals can generate extremely flammable hydrogen gas.		
Special Properties	High heat, hot surface contact, or mixing with acids may spring extremely flammable H ₂ S or disulfide vapors out of this solution. Adding this material directly to unbuffered water may cause an exothermic reaction sufficient enough to make the water boil.		

Sulfidic Caustic Solution

- Extinguishing Media** Non-combustible, if handled and stored properly. Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.
- Protection of Fire Fighters** This material is not expected to burn. However, in the event that gases are being generated or surrounding materials are involved in a fire, firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Avoid contact with damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. For large spills, dike far ahead of spill to maximize later product recovery or disposal. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and proper protective clothing during cleanup operations. This material may react strongly with acids. Never flush to the sewer. In urban areas, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists to minimize physical habitat damage. If appropriate, neutralize with a dilute solution of boric acid or acetic acid. A vacuum truck may be used to collect the bulk. Spills on other than pavement may be handled by removing the affected soil and placing it into approved containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

- Handling** **Danger! Corrosive Liquid!** Do NOT breathe mist or vapor; it may contain sodium hydroxide. Odor is not an adequate warning of potentially hazardous air concentrations. Do not get in eyes, on skin, or on clothing. Wear suitable personal protective equipment to prevent eye and skin contact. Use only with adequate ventilation and wear suitable personal protective equipment. Do not allow material to contact eyes, skin or other tissues, and clothing. Wear corrosion-resistant protective work clothing and chemical splash goggles and face shield when contact is anticipated. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials.
- When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits shown in Section 8. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.
- Empty containers may contain material corrosive residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.
- Storage** Store and transport in accordance with all applicable laws. Store in containers appropriate for concentrated or dilute caustic solutions and away from strong acids. Diluted material may accelerate corrosion of metal containers. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. The sulfite component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

Sulfidic Caustic Solution

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls No special ventilation is required under normal conditions of use. Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Thermal protection should be provided if the solution has a temperature above 120 degrees F. Suitable eye wash water should be readily available.

Hand Protection Avoid skin contact. Use of chemical-resistant gloves (e.g., PVC, neoprene, nitrile, or PVC/NBR) is required. Thermal protection should be used whenever the solution has a temperature above 120 degrees F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.

Body Protection Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (e.g., vinyl, Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, sticker suit, boots, and additional facial protection. Thermal protection should be provided when the solution has a temperature above 120 degrees F. If general contact occurs, IMMEDIATELY remove soaked clothing and shower thoroughly. Contaminated leather goods should be removed immediately and discarded.

Respiratory Protection Misting or vapor generation are not expected under normal conditions of use. Therefore, the need for respiratory protection from diluted sodium hydroxide is not anticipated under normal use conditions and with adequate ventilation. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).

General Comments Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners. Exposure standards/control limits for some of the components apply to airborne concentrations of dust, and are not truly applicable to liquid solutions. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Sodium hydroxide	CEIL: 2 (mg/M ³) from ACGIH (TLV) CEIL: 2 (mg/M ³) from OSHA (PEL) [Proposed] TWA: 2 (mg/M ³) from OSHA (PEL)
2) Sodium Bisulfite	TWA: 5 (mg/M ³) from ACGIH (TLV) TWA: 5 (mg/M ³) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Slightly turbid, light green to light blue.	Odor	Pungent phenolic or sulfurous-type.
Specific Gravity	1.11 to 1.22 (Water = 1)	pH	13.0 to 14.0 [Highly Basic.]	Vapor Density	3.7 to 3.9 (Air = 1)
Boiling Point/Range	100° to 113°C (212° to 235°F)		Melting/Freezing Point	-32° to -10°C (-25° to 14°F)	
Vapor Pressure	110 to 135 mm of Hg at 60°C (140°F)		Viscosity (cSt @ 40°C)	No data available.	

Sulfidic Caustic Solution

Solubility in Water	Partially soluble in cold water, but causes an exothermic reaction.	Volatile Characteristics	Negligible volatility in proper storage.
Additional Properties	Boiling point and melting point temperatures increase with the level of sodium hydroxide present. A 7.5% solution of sodium hydroxide has a pH of 14.0. Average Calculated Density = 9.75 lbs./gallon at 60°F (15.5°C).		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Caustic solutions may react with strong acids, releasing heat and acid gases. Contact with some metals can generate extremely flammable hydrogen gas. Avoid direct contact with water, leather, wool, and organic halogen or nitro compounds.		
Materials Incompatibility	Strong acids, some heavy metals, and some organic chemicals. Caustic solutions are corrosive to tin, aluminum, zinc, and alloys containing these metals and will react violently with their powdered forms. Toxic carbon monoxide gas can form when caustic solutions contact with reducing sugars, food, and beverage products in enclosed spaces and it can cause death. Appropriate tank entry procedures must be followed.		
Hazardous Decomposition Products	None is expected; but no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Sodium Hydroxide:	
DERMAL (LD ₅₀):	Acute: 1,350 mg/kg [Rabbit].
INTRAPERITONEAL (LD ₅₀):	Acute: 40 mg/kg [Mouse].
Sodium Bisulfite:	
ORAL (LD ₅₀):	Acute: 2,000 mg/kg [Rat].
INTRAPERITONEAL (LD ₅₀):	Acute: 244 mg/kg [Dog] - Respiratory depression, cyanosis, and convulsions.
INTRAPERITONEAL (LD ₅₀):	Acute: 300 mg/kg [Rabbit] - Respiratory depression, cyanosis, and convulsions.
INTRAPERITONEAL (LD ₅₀):	Acute: 475 mg/kg [Rat] - Altered sleep times and convulsions.
INTRAPERITONEAL (LD ₅₀):	Acute: 487 mg/kg [Hamster].
INTRAPERITONEAL (LD ₅₀):	Acute: 675 mg/kg [Mouse] - Respiratory depression, cyanosis, and convulsions.
INTRAPERITONEAL (LD ₅₀):	Acute: 779 mg/kg [Guinea Pig].
INTRAVENOUS (LD ₅₀):	Acute: 65 mg/kg [Rabbit] - Respiratory depression and convulsions.
INTRAVENOUS (LD ₅₀):	Acute: 95 mg/kg [Hamster] - Respiratory depression and convulsions.
INTRAVENOUS (LD ₅₀):	Acute: 115 mg/kg [Rat] - Respiratory depression and convulsions.
INTRAVENOUS (LD ₅₀):	Acute: 130 mg/kg [Mouse] - Respiratory depression and convulsions.

Sodium hydroxide (Lye) is strongly alkaline and very corrosive to many organic compounds. If ingested, sodium hydroxide can cause severe pain, bloody diarrhea, cardiovascular collapse, and death. It is a severe eye, skin, and respiratory tract irritant and in an undiluted form it can burn tissue upon contact. It gelatinizes the tissue, forming deep and painful lesions. Squamous cell carcinomas (cicatrical tumors) frequently develop in healing tissue at the site of chemical burns or in scar tissue after a delay of 10 to 20 years. Sodium hydroxide has also been shown to cause chromosomal aberrations in hamster ovary cells and grasshoppers. In general, however, pH alterations produce false positive results in short-term genetic assays.

Sodium phenolates are severe eye, skin, mucous membrane, and upper respiratory tract irritants.

Some **sulfates and sulfites** have been known to cause allergic reactions of the skin and/or respiratory systems of sensitized individuals. **Sodium sulfite** has caused retarded growth, neuritis, bone marrow atrophy, depression, and paralysis in experimental animals. Additionally, it has been found to cause reproductive and mutagenic effects in some plant and animal tests.

Sodium bisulfite and sodium sulfate have been shown to be embryotoxic and teratogenic in mice. The actual human reproductive hazard is unknown.

Sulfidic Caustic Solution

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage; however, due caution should be exercised to prevent the accidental release of this material into the environment. Sodium hydroxide is toxic by ingestion. Contaminated food stuffs must not be eaten by humans or animals.
Environmental Fate	This material is soluble in water and is expected to readily disperse in marine environments. Caustic solutions have produced slight to moderate toxicity in laboratory tests with aquatic organisms. It is expected to be strongly alkaline. If released to surface water, it will cause the pH rise depending upon the buffering capacity of the waterbody. Aquatic organisms become increasingly stressed as pH concentration exceeds 9.0, with many species being intolerant of pH of 10.0 or higher. Substances in this mixture do not bioaccumulate.
	For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHMTADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovery and reuse, rather than disposal, should be the ultimate goal for handling this corrosive alkaline material. However, conditions of use may cause this material to become a hazardous waste (D002), as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Phenolates, liquid or Sodium hydroxide, solution		
Hazard Class	8 (Corrosive)	Packing Group(s)	PG II or PG III
		UN/NA ID	UN2904 or UN1824
Reportable Quantity	A Reportable Quantity (RQ) substance components in this stream which require DOT HAZMAT bill-of-lading display are Sodium Hydroxide and Sodium Bisulfite .		
Placards		Emergency Response Guide No.	154
		HAZMAT STCC No.	49 356 47 or 49 366 53
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material might contain the following chemical substance subject to this statute: Sulfur Dioxide [CAS No. 7446-09-5] concentration: 0 to 0.05%.

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Sulfidic Caustic Solution

SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) Health, Chronic (Delayed) Health, and Reactivity Hazards
SARA 313	This material does not contain any components in concentrations above de minimis levels that are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Sodium Hydroxide [CAS No. 1310-73-2] (RQ = 1000 lbs. [453.6 kg]) concentration: 10 to 20% Sodium Bisulfite [CAS No. 7631-90-5] (RQ = 5,000 lbs. [2,268 kg]) concentration: 0.1 to 0.5%.
CWA	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION	Logo and Manufacturer name change.
Version Number	3.2
Revision Date	11/01/06

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists				AIHA = American Industrial Hygiene Association		
IARC = International Agency for Research on Cancer				NTP = National Toxicology Program		
NIOSH = National Institute of Occupational Safety and Health				OSHA = Occupational Safety and Health Administration		
NPCA = National Paint and Coating Manufacturers Association				HMIS = Hazardous Materials Information System		
NFPA = National Fire Protection Association				EPA = Environmental Protection Agency		

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****

A Lyondell Company

Company
Houston Refining
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Material Safety Data Sheet

Slop Oil

MSDS No
AP1170RS00012
HFR#230Formerly
AP1170

HMIS	IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product.	Protective Equipment
Health Hazard *2	This product is covered by the OSHA Hazard Communication Standard and this document has been prepared in accord with the MSDS requirements of the rule.	
Fire Hazard 3		
Reactivity 0		
* = Chronic Health Hazard		

SECTION 1: IDENTIFICATION

Trade Name	Slop Oil	MSDS No.	AP1170
Product Number	008002060*	Revision Date	11/01/06
CAS Number	Mixture		
Synonyms	Reclaimed Petroleum Waste Oil; Off-test Refinery Streams Slop.		
Generic Name	Petroleum Slop	Business Contact	
Chemical Family	Petroleum Hydrocarbons and Water	Product Safety	800-700-0946
		24 Hour Emergency Contact	
		CHEMTREC	800-424-9300
		CANLITEC-Canada	613-996-6666
		LYONDELL	800-245-4532

SECTION 2: COMPOSITION

Component Name	CAS Number	Carcinogenic Listings	Concentration Wt%
SLOP OILS, MIXED WHICH CONTAINS	Mixture	Not applicable	EQ 100
SLOP OIL, C20+ HYDROCARBONS	68476-53-9	Not applicable	67 to 97
SLOP OIL, C7 - C10 HYDROCARBONS	68956-48-9	Not applicable	1 to 5
SLOP OIL, C5 - C12 HYDROCARBONS	68956-70-7	Not applicable	1 to 5
4-6 FUSED-RING POLYNUCLEAR AROMATIC HYDROCARBONS (PNA'S)	68487-58-6	IARC,NTP,OSHA,ACGIH	1 to 20
XYLENE (TOTAL OF ALL ISOMERS)	1330-20-7	Not applicable	1 to 2
ETHYL BENZENE	100-41-4	IARC (Group 2B),ACGIH	0.2 to 0.5
NAPHTHALENE	91-20-3	IARC (Group 2B)	0.1 to 0.5
BENZENE	71-43-2	IARC,NTP,OSHA,ACGIH	0.01 to 0.5
HYDROGEN SULFIDE	7783-06-4	Not applicable	LT 0.1 to 0.25
WATER	7732-18-5	Not applicable	0.1 to 1

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Signal Word	DANGER!	Color	Dark yellow to brown or greenish-black.
Physical State	Viscous liquid.	Odor	Faint, pleasant hydrocarbon to pungent, offensive sulfurous. Odor threshold is 0.1 to 0.5 ppm in air.
Physical and Health Hazards	Extremely to moderately flammable liquid! Vapor may cause flash fire or explosion! May release toxic Hydrogen Sulfide vapors, especially when heated and/or agitated! May cause eye, skin, mucous membrane, and respiratory tract irritation or dermal sensitization! May be harmful or fatal if inhaled, ingested, or absorbed through the skin! Aspiration into the lungs will cause pulmonary edema and lipid pneumonia! Overexposures may cause central nervous system (CNS) depression and/or damage the lungs, liver, and kidneys! Potential skin cancer hazard! Contains low levels of Benzene, a known human leukemogen, which can cause blood abnormalities. Contains low levels of Ethylbenzene, a suspect human carcinogen, based upon animal studies. Potential slipping hazard on smooth, hard walking area. If heated, may react violently with water.		

Environmental Hazards

Emission of vapors into the atmosphere occurs everywhere along the production, collection, handling, and marketing distribution chain, beginning at the oil field, continuing through bulk storage and handling, transport, and unloading operations at the petroleum refinery. Vapors released into the ambient air are subject to processes of transport, dilution, and dispersion, which reduce their concentrations, but spread them over wide areas.

Toxic Aromatic Hydrocarbon compounds (Benzene, Xylenes, etc.) from petroleum are both volatile and water soluble; and therefore, they are commonly found in contaminated groundwater and the vapor phase above it. Petroleum oils spilled on oceans and waterways annually causes significant loss of aquatic and avian animal populations.

POTENTIAL HEALTH EFFECTS

Routes of Exposure Inhalation; Eye Contact; Skin Contact; and Skin Absorption.

Signs and Symptoms of Acute Exposure

- **Inhalation** Breathing mist or vapors may irritate the mucous membranes of the nose, throat, bronchi, and lungs, and may cause transient central nervous system (CNS) depression, depending on the concentration and/or duration of exposure. CNS symptoms include headache, dizziness, nausea, intoxication, blurred vision, slurred speech, flushed face, confusion, weakness, fatigue, loss of consciousness, convulsions, coma, and death.
- **Eye Contact** Mild to moderate eye irritation may result from short-term contact with liquid, mist, and/or vapor. Hydrogen Sulfide vapors can cause eye irritation which may lead to light (photo-) sensitivity and eye damage.
- **Skin Contact** Minimal to mild skin irritation may result from short-term contact with liquid or mist. Absorption from massive or prolonged liquid contact may cause poisoning. Repeated skin contact may also cause allergic reactions in highly-sensitive individuals and has been shown to increase toxicity of other skin sensitizing agents.
- **Ingestion** Ingestion is highly unlikely; however, if swallowed, this product may cause irritation to the mouth, throat, and stomach and/or gastrointestinal disturbances. Retention may produce nausea, vomiting, diarrhea, restlessness, sedation, and inadequate respiratory and/or cardiac function. Aspiration into the lungs, which is likely to occur during the swallowing or vomiting, will cause pneumonia.

Chronic Health Effects Summary

Prolonged and/or repeated contact may cause skin defatting, oil acne, redness, itching, dryness, blistering, lesions, scaly dermatitis, and possibly, secondary infection. The presence of various heavy metals in crude petroleum oils may also pose a bioaccumulation potential which could lead to systemic toxicity by repeated or prolonged inhalation, ingestion, or skin absorption.

The International Agency for Research on Cancer (IARC) has concluded that for Crude Petroleum Oils there is limited evidence of carcinogenicity in experimental animals and inadequate evidence for assessing its carcinogenicity in humans. However, rodent studies have shown that the Heavy Naphtha, Distillate, and higher-boiling fractions of some Crude Petroleum Oils have produced skin tumors and/or target organ damage following prolonged and repeated application. Usually, these tumors appeared during the latter portion of the typical 2-year lifespan of the animals. Crude Petroleum Oils also contain Polynuclear Aromatic Hydrocarbons (PAHs or PNAs), some of which have been reported to cause skin cancer on humans under conditions of poor personal hygiene, prolonged/repeated contact, and exposure to sunlight. Toxic effects are unlikely to occur if good personal hygiene is practiced.

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational xylene exposures have caused auditory nerve degeneration.

At high exposure concentrations, ethylbenzene has been associated with multiple organ tumors in laboratory animals.

Based upon animal testing, the C8 aromatic hydrocarbon components (xylene isomers and ethylbenzene) might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period.

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic. (See Section 11.)

Conditions Aggravated by Exposure	Personnel with pre-existing CNS disease, skin disorders, impaired liver or kidney function, or chronic respiratory diseases should avoid exposure.
Target Organs	Eyes, skin, mucous membranes, lungs, nervous system, liver, kidneys, thymus, spleen, blood and bone marrow, lymph nodes, and reproductive organs.
Carcinogenic Potential	Please refer to Sections 2 and/or 11 for the identification of components, if any, which have been identified as having carcinogenic potential in animals and/or humans.

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS -

Inhalation	If vapors are still suspected to be present, the rescuer must wear an appropriate supplied-air respirator or self-contained breathing apparatus (SCBA). Evacuate the victim to a safe area as soon as possible. If the victim is breathing, check for unusual breath odors. Loosen tight clothing such as a collar, tie, belt, or waistband. If breathing is difficult, administer air or oxygen. If the victim is not breathing, perform cardiopulmonary resuscitation (CPR), as necessary. Maintain an open airway. WARNING: Persons providing mouth-to-mouth resuscitation may be placing themselves at risk either from toxic materials or communicable disease.
Eye Contact	IMMEDIATELY flush the eye(s) with large volumes of clean, low-pressure water for at least 15 minutes, occasionally lifting both the upper and lower eyelids. If pain or redness persists after flushing, obtain medical attention.
Skin Contact	Remove contaminated clothing as soon as possible. Wash affected skin thoroughly with mild soap and water. If irritation persists or if tissue appears damaged, seek medical attention. Wash contaminated clothing before reuse. Discard contaminated leather shoes and gloves.
Ingestion	DO NOT INDUCE VOMITING! Risk of damage to the lungs generally exceeds the poisoning risk. (See "Ingestion" in Section 3.) If the patient is completely conscious and alert, give one to two pints of lukewarm water or milk. Obtain medical attention IMMEDIATELY .
Notes to Physician	Aspiration of this material into the lungs will cause lipid or chemical pneumonia. As a result, induction of emesis is NOT recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as Magnesium Citrate or Sorbitol. For quantities above a few drops, use careful gastric lavage with a tight-fitting, cuffed endotracheal tube for complete emptying. Treat symptomatically.

SECTION 5: FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

Flammability Classification	Extremely Flammable! OSHA/NFPA Class-IB Flammable Liquid.
Flash Point/Method	LT 40°F (4°C) by ASTM D-56.
Flammable Limits %	LEL: AP 0.9% UEL: AP 7.0% (Based on NFPA "Crude Petroleum")
Auto-Ignition Temperature	AP 500°F (260°C) (Based on NFPA "Hydrogen Sulfide")
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, aldehydes, and other harmful gases/vapors including oxides and/or other compounds of heavy metals, nitrogen, sulfur, and possibly, hydrogen sulfide and alkyl mercaptans. Hydrogen sulfide is corrosive to many materials when moisture is present.
Special Properties	<p>Evolved Hydrogen Sulfide vapor may cause a flash fire or explosion! Keep away from all ignition sources! This vapor may be released at well below ambient temperatures and readily forms flammable mixtures with air. Exposed to an ignition source, it will burn in the open or explode in confined spaces. Being heavier than air, its flammable vapors may travel long distances along the ground before reaching a point of ignition and flashing back.</p> <p>When heated above its flash point temperature, this material will release flammable vapors which if exposed to an ignition source can burn in the open or be explosive in confined spaces. Mists or sprays may be flammable at temperatures below the flash point.</p> <p>A static electrical charge may accumulate as a result of transfer flow or agitation. Discharge (static spark) may ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing Gasoline or other low flash point products</p>

EXTINGUISHING MEDIA

SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (Halon or nitrogen). LARGE FIRE: Use water fog, waterspray, or foam. Foam and water are effective but may cause frothing. NEVER use a water jet because it may spread the fire to a larger area.

FIRE FIGHTING

Do not enter any enclosed or confined fire space without proper protective clothing and equipment. This must include a self-contained breathing apparatus to protect against the hazardous effects of combustion products and/or oxygen deficiencies. Cool tanks and containers exposed to fire with water. Withdraw immediately in case of rising sound from venting safety device or discoloration of the vessel, tank, or pipeline. Be aware that burning liquid will float on water. Notify the appropriate authorities if liquid(s) enter sewers or waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS.

Flammable Liquid! Release causes a potential fire or explosion hazard. Remove all ignition sources and safely stop flow of spill. Evacuate all non-essential personnel from immediate area, kill or isolate all ignition sources, and limit area access to only HAZWOPER-trained and properly equipped emergency personnel. Contain spill and prevent it from entering sewers or waterways. Material will float on water and its run-off may create an explosion or fire hazard. Absorb spill with an inert material and place in an appropriate waste disposal container.

Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate protective clothing/equipment, including organic respirators or supplied air. Dike far ahead of a liquid spill to ensure complete collection. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Some spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING and STORAGE**Handling**

Do not handle near heat, sparks, or open flame. Spill/leak can cause fire/explosion. Keep container tightly closed. Do not contact with oxidizable materials. Use only with adequate ventilation/personal protection. Do not breathe vapor. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials. Do not take internally. Keep containers closed and do not handle near heat, sparks, or open flame. A spill or leak can cause fire/explosion. Remove spillage immediately from hard, smooth walking areas. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials. Do not take internally.

Sampling, transportation, and shipping personnel should use extreme caution when opening a sealed container or entering confined areas of stored petroleum oils. Hydrogen sulfide vapors may accumulate in tanks and transport compartments. Avoid breathing vapors when opening hatches and dome covers by staying upwind, venting slowly, and keeping your face away from compartment openings. Proper respiratory equipment should be used when entering any area where these vapors are being emitted. Hydrogen sulfide's (rotten egg) odor is not reliable as a warning of possible overexposure!

All material sampling should be conducted in a manner which avoids vapor inhalation or skin contact. All electrical equipment in areas where product is handled/stored should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). Parts and equipment using or containing this material should be steam-cleaned if possible prior to all maintenance procedures. Empty containers retain some liquid and vapor residues, so all hazard precautions must be observed when handling empty containers.

Storage

Flammable materials should be stored in floating-roof tank or a separate safety storage cabinet or room. Keep containers tightly closed in a cool, dry, well-ventilated place. Ground all equipment containing this material. A refrigerated room would be preferable for materials with a Flash Point lower than 70°F (AP 21°C). Keep away from heat and all other sources of ignition. **KEEP OUT OF CHILDREN'S REACH!**

SECTION 8: EXPOSURE CONTROLS and PERSONAL PROTECTION**ENGINEERING CONTROLS**

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. Ensure that an eyewash station and safety shower are proximal to the work-station location.

PERSONAL PROTECTIVE EQUIPMENT• *Protective Equipment*• *Eye Protection*

Safety glasses with side shields are recommended as a minimum protection. Whenever there is a likelihood of misting or splashing/spraying liquid, chemical goggles and/or a face shield should be worn. Suitable eye wash water should be readily available. Hard contact lenses **MUST NOT** be worn.

• *Skin Protection*- *Hands*

Gloves (impervious, Neoprene or Nitrile). Wash hands with plenty of mild soap and water before eating, drinking, smoking, using toilet facilities, or leaving work. **DO NOT** use Kerosene, solvents, or harsh abrasive skin cleaners.

- *Body*

Avoid skin contact. If splashing or spraying is expected, impervious (Neoprene or Tyvek) protective clothing should be worn. This clothing might include long sleeves, apron, lab coat, boots, and additional facial protection. If general contact occurs, **IMMEDIATELY** take a shower. Remove soaked clothing as soon as possible and launder thoroughly before reuse. Discard contaminated leather gloves and shoes.

• *Respiratory Protection*

For unknown vapor concentrations use a self contained breathing apparatus (SCBA). For known vapor concentrations, above the exposure guidelines shown in this Section, also use a NIOSH/MSHA-approved SCBA or supplied air. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent.

• *General Comments*

Warning! Burning this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Since specific exposure standards/control limits have not been established for this product, the "Oil Mist, Mineral" exposure limits shown below are suggested as minimum control guidelines.

EXPOSURE GUIDELINES

Substance	Source	Date	Type	Value	Time
HYDROGEN SULFIDE	OSHA	1989	PEL	10 ppm	8 Hrs
HYDROGEN SULFIDE	OSHA	1989	STEL	15 ppm	15 Mins
HYDROGEN SULFIDE	OSHA	1989	CEILING	20 ppm	1 Min
HYDROGEN SULFIDE	OSHA	1972	PEAK	50 ppm	10 Mins
HYDROGEN SULFIDE	ACGIH	2000	TLV	10 ppm	8 Hrs
HYDROGEN SULFIDE	ACGIH	2000	STEL	15 ppm	15 Mins
BENZENE	OSHA	1987	AL	0.5 ppm	8 Hrs
BENZENE	OSHA	1987	PEL	1 ppm	8 Hrs
BENZENE	OSHA	1987	STEL	5 ppm	15 Mins
BENZENE ("A1" Known Human Carcinogen)	ACGIH	2000	TLV	10 ppm	8 Hrs
XYLENE (XYLOL)	OSHA	1989	PEL	100 ppm	8 Hrs
XYLENE (XYLOL)	OSHA	1989	STEL	150 ppm	15 Mins
XYLENE (ortho-, meta-, & para-ISOMERS)	ACGIH	2000	TLV	100 ppm	8 Hrs
XYLENE (ortho-, meta-, & para-ISOMERS)	ACGIH	2000	STEL	150 ppm	15 Mins
ETHYL BENZENE	OSHA	1989	PEL	100 ppm	8 Hrs
ETHYL BENZENE	OSHA	1989	STEL	125 ppm	15 Mins
ETHYL BENZENE ("A3" Animal Carcinogen proposed for 2001)	ACGIH	2000	TLV	100 ppm	8 Hrs
ETHYL BENZENE ("A3" Animal Carcinogen proposed for 2001)	ACGIH	2000	TLV	125 ppm	15 Mins
OIL MIST, MINERAL	OSHA	1989	PEL	5 mg/M3	8 Hrs
PARTICULATE POLYCYCLIC AROMATICS (PPAH) ("A1" Carcinogen)	ACGIH	2000	TLV	0.2 mg/M3	8 Hrs
COAL TAR PITCH VOLATILES (CTPV) (as Benzene Solubles)	OSHA	1989	PEL	0.2 mg/M3	8 Hrs
OIL MIST, MINERAL (Sum of 15 PAHs listed as NTP Carcinogens) ("A1" Known Human Carcinogen proposed for 2001)	ACGIH	2001	TLV	0.005 mg/M3	8 Hrs

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Viscous liquid.		
Color	Dark yellow to brown or greenish-black.		
Odor	Faint, pleasant hydrocarbon to pungent, offensive sulfurous. Odor threshold is 0.1 to 0.5 ppm in air.		
pH	Not applicable.		
Vapor Pressure	AP 0.8 to 2.6 psia at 100°F. or 100 to 800 mm of Hg at 68°F.	Viscosity	AP 300 to 1000 SUS at 100°F. (ASTM D-2161)
Vapor Specific Gravity	AP 5 to 9 when Air = 1 at 70°F.	Melting/Freezing Pt.	LT 32°F (0°C) (ASTM D-97)
Volatile Characteristics	Appreciable (10 to 50 Wt.%)	Solubility in Water	Slight (0.1 to 1.0 Wt.%)
Boiling Point/Range	AP 50° to 1200°F (ASTM D-86) (AP 10° to 650°C)	Specific Gravity	AP 0.74 to 0.99 (ASTM D-1250)
Additional Properties	API Gravity ranges from 22 to 30.		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.
Conditions to Avoid	Heat, sparks, and open flames. Extended-period, heated storage of petroleum oil may evolve hydrogen sulfide, a flammable, toxic, and potentially deadly gas.
Incompatibility with Other Materials	Strong acids, alkalis, and oxidizers such as liquid chlorine, concentrated oxygen, and sodium or calcium hypochlorite.
Hazardous Decomposition Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, aldehydes, and other harmful gases/vapors including oxides and/or other compounds of heavy metals, nitrogen, sulfur, and possibly, hydrogen sulfide and alkyl mercaptans. Hydrogen sulfide is corrosive to many materials when moisture is present.
Hazardous Polymerization	Not expected to occur.

SECTION 11: TOXICOLOGICAL INFORMATION**PETROLEUM:**

ORAL (LD50):	Acute: GT 4,300 mg/kg (Rat screen level).
ORAL (LD50):	Acute: GT 4,300 mg/kg (Mouse screen level).
DRAIZE EYE:	Acute: Mild to moderate eye irritant (Rabbit).
DRAIZE DERMAL:	Acute: Minimal to mild skin irritant (Rabbit).
BUEHLER DERMAL:	Acute: Sensitizer (Guinea Pig).
4-Day ORAL (TDLo):	Sub-chronic: 1,250 uL/kg (Rat) - Changes in liver enzymes & proteins.
4-Day ORAL (TDLo):	Sub-chronic: 40 mL/kg (Domestic Bird) - Changes in blood cells & counts.
21-Day ORAL (TDLo):	Sub-chronic: 30 gm/M3 (Rat) - Changes in blood serum, enzyme effects, & stomach absorption rates.
8-Week ORAL (TDLo):	Sub-chronic: 140,000 mg/kg (Duck) - Changes in spleen & ovarian weights.
26-Week ORAL (TDLo):	Chronic: 455,000 mg/kg (Duck) - Changes in liver weight & blood composition
10-Week DERMAL:	Sub-chronic: 40,000 mg/kg (Mouse) - Skin tumors at site of application.
104-Week DERMAL:	Chronic: 210 to 3,745 mg/kg (Mouse) - Skin tumors at site of application.
87-Weeks INTRAPLEURAL:	Chronic: 182,000 mg/kg (Rat) - Lung & thorax tumors.
MUTAGENICITY:	
in-vivo Sister Chromatid Exchange:	Positive (Mouse).
in-vivo Micronuclei Exchange:	Positive (Mouse).
in-vitro Lymphoma Assay.	Positive (Mouse).
in-vitro SCE Ovary Assay.	Positive (Chinese Hamster).

Lifetime mouse skin painting studies have shown that some **Petroleum Crude Oils and their Middle Distillate fractions (boiling range of 300° to 700°F)** can cause skin tumors when repeatedly applied and never washed from an animal's skin. The skin tumor potency seems to increase with the Sulfur content and/or boiling point range. The 700° to 1,070°F boiling point fractions were highly active, as were all fractions containing Polynuclear Aromatic Hydrocarbons (PNA's or PAH's). The relative significance of these results to human health is uncertain since these oils were not washed from the skin and the resulting skin effects (defatting, irritation, cell damage, etc.) may play a role in the weak tumorigenic response. A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of some Petroleum Middle Distillates.

Several epidemiological studies have shown an association between exposure to **Crude Petroleum Oils (or Crude Oil refining operations)** and cancer. Deaths from cancers of the lung, nasal cavity and sinuses, and skin were higher in U.S. counties where Petroleum industries were concentrated during the period of 1950 through 1969. In a Canadian study, employees exposed daily to Crude Petroleum Oils or their products had more than three times the risk of dying from esophageal and stomach cancer and twice the risk for lung cancer as non-exposed employees. In one Petroleum refinery in Washington state, workers were found to have an 8.5-fold excess risk of dying from astrocytic tumors in the brain as compared with age-matched controls. Other small population Petroleum refinery studies have shown increased death risks due to intestinal, kidney, and bladder cancers.

Crude Petroleum Oils and some of its components were found to be mutagenic by "in vitro" and "in vivo" testing. The genetic activity is expected due to "Aromatic Hydrocarbon compounds". The relationship between these results and possible human effects is not known.

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

There were no Benzene-induced blood toxin or leukemia effects noted in laboratory animals following long-term exposures to fully-volatilized **Unleaded Gasoline vapors containing 2 Vol.% Benzene**. However, the relative risk to humans for Benzene is still unknown.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Chronic overexposure to xylene may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes) and ethylbenzene** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes. The significance of these animal study results to humans is not known. Xylenes may also cause teratogenic effects.

Two-year rat and mouse gavage (forced feeding) studies by the National Toxicology Program (NTP) using **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study with shaved rats and mice showed "no incidence of non-neoplastic or neoplastic lesions". And, none of the components were mutagenic when tested in the modified Ames assay, Chinese hamster ovary (CHO) cell assay (with and without metabolic activation), or the in-vitro CHO sister-chromatid exchange (SCE) assay.

The National Toxicology Program (NTP) completed a 2-year inhalation bioassay of ethylbenzene (EB) in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the International Agency for Research on Cancer (IARC) has designated EB as possibly carcinogenic to humans (Group 2B).

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction of red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in 8 of 21 workers exposed to elevated levels of naphthalene vapors for 5 years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Based upon animal studies, naphthalene may cause fetal toxicity or damage and decreased spleen weights in pregnant female mice.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay of naphthalene. The study was conducted in male and female F344/N rats at exposure concentrations of 0, 10, 30, and 60 ppm. No significant effects were observed at the 10 ppm levels. However, compared to chamber controls, there was a dose-related increase in tumors generated at the 30 and 60 ppm levels in both males and females. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas, and non-neoplastic lesions of the nose were observed when compared to chamber controls. Additionally, in cytogenic tests with Chinese hamster ovary cells, naphthalene induced significant increases in sister chromatid exchanges with and without metabolic activation (S9) and in chromosomal aberrations with S9. The relevance of these findings to human health is unclear.

SECTION 12: ECOLOGICAL INFORMATION

Toxic aromatic hydrocarbon compounds (benzene, xylene isomers, ethylbenzene, etc.) from petroleum oils are volatile; and therefore, they may be released to the atmosphere and react with photochemically-produced hydroxyl radicals to create smog.

Petroleum will normally float on water. In stagnant or slow-flowing waterways, an oil layer can cover a large surface area. As a result, this oil layer might limit or eliminate natural atmospheric oxygen transport into the water. Over time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This oil coating action can also kill plankton, algae, and water birds. Contaminated groundwater is also an important exposure pathway for humans.

Crude Petroleum Oils' water-soluble fractions are potentially toxic to freshwater and saltwater ecosystems. Using shrimp (*Mysidopsis almyra*), various Crude Oils showed a 48-hour TLM (Median Toxic Limit) from 6 ppm to 20 ppm in ambient saltwater. A 24-hour TLM resulted in 10,000 ppm when using freshwater *Daphnia* (*magna* and *pulex*) with many of the organisms being trapped in the oil layer. Based upon actual spill incident investigations, Crude Petroleum Oils have been shown to bioaccumulate in tissues of various fish from 1 to 5 ppm levels.

SECTION 13: DISPOSAL CONSIDERATIONS

Maximize product recovery for reuse or recycling. When disposing of this product, its storage tank water bottoms, sludge, contaminated soil, or water one must assume the waste material to be an EPA "Ignitable Hazardous Waste" (D001) and/or "Toxic Waste" (U018), unless proven otherwise by thorough analytical testing. Use approved treatment, transporters, and disposal sites in compliance with all applicable regulations. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. Vapor emissions from a bio-oxidation process might prove to be a potential health hazard. Potential treatment and disposal methods include incineration, land farming, and/or bioremediation, if permitted.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Petroleum Oil		
Hazard Class	3		
UN/NA ID	UN1270	Packing Group(s)	PG II or PG III
Reportable Quantity	RQs [4-6 FUSED-RING POLYNUCLEAR AROMATIC HYDROCARBONS (PNA's or PAH's), XYLENE (TOTAL OF ALL ISOMERS), ETHYLBENZENE, BENZENE, and NAPHTHALENE.]		
Placards		Emergency Response Guide Number	128
		HAZMAT STCC Number	Not available
		MARPOL III Status	This product might be a "Marine Pollutant".

SECTION 15: REGULATORY INFORMATION

TSCA	All components of this product are listed on the Toxic Substance Control Act (TSCA) inventory.										
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on Reportable Quantities (RQs) established in 40 CFR Parts 302.4 and 355. Components present in this product which may require reporting are: <table border="0" style="width: 100%;"> <tr> <td>XYLENE (TOTAL OF ALL ISOMERS)</td> <td>HYDROGEN SULFIDE</td> </tr> <tr> <td>1,3-BUTADIENE</td> <td>BENZENE</td> </tr> </table>	XYLENE (TOTAL OF ALL ISOMERS)	HYDROGEN SULFIDE	1,3-BUTADIENE	BENZENE						
XYLENE (TOTAL OF ALL ISOMERS)	HYDROGEN SULFIDE										
1,3-BUTADIENE	BENZENE										
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Immediate (Acute) Health and Delayed (Chronic) Health Hazards; Fire Hazard.										
SARA 313	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of an annual release report of "Toxic Chemicals" that appear in 40 CFR 372 (used for SARA 313). This information must be included in all MSDSs that are copied and distributed for this material. Components present in this product at a level which could require reporting under the statute are: <table border="0" style="width: 100%;"> <tr> <td>BENZENE</td> <td>XYLENE (TOTAL OF ALL ISOMERS)</td> </tr> </table>	BENZENE	XYLENE (TOTAL OF ALL ISOMERS)								
BENZENE	XYLENE (TOTAL OF ALL ISOMERS)										
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center of release of quantities of "Hazardous Substances" equal to or greater than the "Reportable Quantities (RQs)" in 40 CFR 302.4. Components present in this product at a level which could require reporting under the statute are: <table border="0" style="width: 100%;"> <tr> <td>4-6 FUSED-RING POLYNUCLEAR AROMATICS (PNA's)</td> <td>RQ: 1 to 100 Pounds (0.45 to 45 Kg.)</td> </tr> <tr> <td>XYLENE (TOTAL OF ALL ISOMERS)</td> <td>RQ: 100 Pounds (45 Kg.)</td> </tr> <tr> <td>ETHYLBENZENE</td> <td>RQ: 100 Pounds (45 Kg.)</td> </tr> <tr> <td>BENZENE</td> <td>RQ: 10 Pounds (4.5 Kg.)</td> </tr> <tr> <td>NAPHTHALENE</td> <td>RQ: 100 Pounds (45 Kg.)</td> </tr> </table>	4-6 FUSED-RING POLYNUCLEAR AROMATICS (PNA's)	RQ: 1 to 100 Pounds (0.45 to 45 Kg.)	XYLENE (TOTAL OF ALL ISOMERS)	RQ: 100 Pounds (45 Kg.)	ETHYLBENZENE	RQ: 100 Pounds (45 Kg.)	BENZENE	RQ: 10 Pounds (4.5 Kg.)	NAPHTHALENE	RQ: 100 Pounds (45 Kg.)
4-6 FUSED-RING POLYNUCLEAR AROMATICS (PNA's)	RQ: 1 to 100 Pounds (0.45 to 45 Kg.)										
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ETHYLBENZENE	RQ: 100 Pounds (45 Kg.)										
BENZENE	RQ: 10 Pounds (4.5 Kg.)										
NAPHTHALENE	RQ: 100 Pounds (45 Kg.)										
California Proposition 65	Per the California Safe Drinking Water and Toxic Enforcement Act of 1986, this product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: 4-6 FUSED-RING POLYNUCLEAR AROMATIC HYDROCARBONS (PNA's or PAH's) <table border="0" style="width: 100%;"> <tr> <td>BENZENE</td> <td>TOLUENE (METHYLBENZENE)</td> </tr> </table> 1,3-BUTADIENE (ERYTHRENE OR PYRROLYENE)	BENZENE	TOLUENE (METHYLBENZENE)								
BENZENE	TOLUENE (METHYLBENZENE)										
Additional Regulatory Remarks	Resource Conservation and Recovery Act (RCRA): This substance, when discarded or disposed of, is not specifically listed as a "Hazardous Waste" in Federal regulations; however, it is considered to be hazardous because it is "toxic" and "ignitable" according to Environmental Protection Agency definitions (40 CFR 261). Additionally, it could be designated as hazardous according to various state and local regulations. This substance could also become a "Hazardous Waste" if it is mixed with or comes in contact with a "Hazardous Waste". If such contact or mixing may have occurred, check 40 CFR 261 to determine its status. If it is a "Hazardous Waste", regulations at 40 CFR 262, 263, and 264 apply. The transportation, storage, treatment, and disposal of "Hazardous Waste" materials must be conducted in compliance with all applicable Federal, state, and local regulations.										

This product is classified as an oil under Section 311 of the Clean Water Act (40 CFR 110) and the Oil Pollution Act of 1990 (40 CFR 112). Discharge or spills which produce a visible sheen on either navigable surface water, or in waterways and sewers which lead to navigable surface water, must be reported to the National Response Center (800-424-8802).

The Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which require special labeling if distributed in a manner intended, or packaged in a form suitable, for use in the household or by children. Precautionary label dialogue must display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! KEEP OUT OF REACH OF CHILDREN! DO NOT SIPHON BY MOUTH!**

Toxic Substances Control Act (TSCA) - Section 12(b): Because this product probably contains detectable amounts of METHYLCYCLOPENTANE, CYCLOHEXANE, n-HEXANE, and/or 1,3,5-TRIMETHYLBENZENE (MESITYLENE), it might be subject to the Export Notification requirements of the Environmental Protection Agency.

SECTION 16: OTHER INFORMATION

HMIS (U.S.A.)

Health Hazard	+2
Fire Hazard	3
Reactivity	0

* = Chronic Health Hazard

National Fire Protection Association (U.S.A.)



REVISION INFORMATION

Version Number 03
 Revision Date 11/01/06
 Latest Revision Logo and Manufacturer name change.

ABBREVIATIONS

AP = Approximately EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data

ACGIH = American Conference of Governmental Industrial Hygienists

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCT FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0102
Revision Date 06/26/2002

HFK# 230
QA Lab
D- HDS
737 COKER
DOCKS
HAZCOM 4
Clarence
Barbara
Melinda
maint 2
medical
MI

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid
Color Transparent, clear to slightly yellow. **Odor** Moderate, sweet and pleasant, aromatic hydrocarbon to gasoline-like.

DANGER! Extremely flammable liquid;
vapor may cause flash fire or explosion!
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!
Liquid contact may cause mild to severe eye and/or moderate to severe skin irritation and inflammation!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects!
May be harmful or fatal if ingested!
Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Potential cancer hazard! Contains Benzene and Ethylbenzene!
May cause leukemia and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
May adversely affect reproduction or reproductive development!
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)	Technical Contact	(800) 525-4892 or (713) 321-4269 (M-F)
Product Number	064741839*	Medical Emergency	(918) 495-4700
CAS Number	64741-83-9	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	C6-C12 Petroleum Hydrocarbons		
Synonyms	Heavy Coker Naphtha; Delayed Coker Heavy Gasoline or Naphtha; Thermal Cracked Heavy Gasoline; 534 Depentanizer Tower Bottoms; Coker Naphtha Splitter Tower Bottoms; 632 HDS Feed; Coker Naphtha Fractionator (CNF) Bottoms; Heavy Thermal Cracked Naphtha (Petroleum); HTC.N.		

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Heavy Thermal Cracked Naphtha (Petroleum)	64741-83-9	100
2) Hexane isomers	Mixture	0.5-2
3) Benzene	71-43-2	0.1-0.9
4) Heptanes	Mixture	5-15
5) Methylcyclohexane	108-87-2	1-5
6) Toluene	108-88-3	1-5
7) C7-C12 alpha-Alkenes	68855-57-2	5-15
8) Octanes	Mixture	15-25
9) Xylene, Mixed Isomers	1330-20-7	5-10
10) Ethylbenzene	100-41-4	1-2
11) Nonanes	Mixture	10-25
12) n-Propylbenzene	103-65-1	0.5-1.5
13) Trimethylbenzene (mixed isomers)	25551-13-7	5-10
14) 1,2,4-Trimethylbenzene (Pseudocumene)	85-63-6	3-8
15) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-10
16) Indene	95-13-6	0.5-1.5
17) Naphthalene	91-20-3	0.5-1.5
18) C10-C12 Alkylbenzenes	70693-06-0	2-10
19) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	5-10

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this product can cause mild to severe eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials suggest that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).
	Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

Chronic Health Effects Summary

Reports have associated repeated and proplonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome") And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delinum, seizures, and sudden death have been common results for gasoline/naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this product may be harmful or fatal

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes) Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities

Chronic effects of ingestion and subsequent aspiraton into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction Chronic occupational **toluene and xylene** exposures have caused auditory nerve degeneration.

At high exposure concentrations, **ethylbenzene** has been associated with multiple organ tumors in laboratory animals.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylene isomers and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period And, the **C9 aromatic hydrocarbons (cumene, n-propylbenzene, trimethylbenzenes, Indene, and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period.

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, or chronic respiratory diseases, and women attempting to conceive should avoid exposure.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinepherine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

This material is toxic to lungs, central nervous system, especially the auditory nerves, brain, blood, kidneys, liver, heart, thymus, mucous membranes, skin, eyes, and possibly the reproductive system.

Carcinogenic Potential

This material contains benzene and ethylbenzene at concentrations above 0 1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP and Ethylbenzene are considered possibly carcinogenic to humans by IARC. (See Section 11.)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonia. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p> <p>Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable!		
Flash Point Method	CLOSED CUP: -37° to 0°C (-35° to -18°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 0.9 %	Upper Flammable Limit	AP 7.6%
Autoignition Temperature	225° to 280°C (435° to 536°F) by ASTM E-659.		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors including oxides of sulfur and nitrogen.		
Special Properties	Extremely Flammable Liquid! This material releases vapors at or well below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

Protection of Fire Fighters Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Gasoline ("A3" Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) TWA: 300 STEL: 500 (ppm) from OSHA (PEL) [Proposed]
2) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) TWA: 500 (ppm) from OSHA (PEL)
3) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
4) Benzene ("A1" and "Z-2" Known Human Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) - SKIN TWA: 1 STEL: 5 (ppm) from OSHA (PEL) - SKIN
5) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed]
6) Methylcyclohexane	TWA: 500 (ppm) from OSHA (PEL) TWA: 400 (ppm) from ACGIH (TLV) TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
7) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL)
8) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
9) Xylene, Mixed Isomers	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 100 (ppm) from OSHA (PEL)

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

10) Ethylbenzene ("A3" Animal Carcinogen)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [Proposed]
11) Nonane, all isomers	TWA: 100 (ppm) from OSHA (PEL) TWA: 200 (ppm) from ACGIH (TLV) TWA: 200 (ppm) from OSHA (PEL) [Proposed]
12) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) TWA: 25 (ppm) from OSHA (PEL) [Proposed]
13) Indene	TWA: 10 (ppm) from ACGIH (TLV) TWA: 10 (ppm) from OSHA (PEL) [Proposed]
14) Naphthalene ("A3" = Animal Carcinogen [Proposed])	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed] TWA: 10 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color Transparent, clear to slightly yellow.	Odor	Moderate, sweet and pleasant, aromatic hydrocarbon to gasoline-like.
Specific Gravity	0.83 to 0.85 (Water = 1)	pH Not applicable.	Vapor Density	3.1 to 3.5 (Air = 1)
Boiling Point/Range	60° to 235°C (140° to 455°F) [ASTM D-2887]		Melting/Freezing Point	< -46°C (-50°F)
Vapor Pressure	2.0 to 2.2 Reid-psi at 38°C (100°F).		Viscosity (cSt @ 40°C)	1 to 2
Solubility in Water	Soluble in methanol and diethyl ether. Slightly soluble in cold water (< 0.1%).		Volatile Characteristics	Volatile Organic Compounds (VOCs) Content = 100%; 750 to 875 gm/L.
Additional Properties	Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 35 to 75 Wt.% [ASTM D-1319]; C6-C12 Aromatic Hydrocarbons Content = 20 to 50 Wt.% [ASTM D-1319]; Olefin Hydrocarbons Content = 5 to 15 Wt.% [ASTM D-1319]; Average Density at 60°F = 6.202 lbs./gal. [ASTM D-2500]; Evaporation Rate = 0.35 to 2.0 when n-Butyl acetate = 1.0; 90% Boiling Point Temperature = 415° to 435°F (213° to 224°C) [ASTM D-86]; Dry Point Temperature = 450°F (232°C) [ASTM D-86]; Net Heat of Combustion Value = 18,600 to 20,600 Btu/lb. [ASTM D-1405 or D-2382].			

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalies, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Heavy Thermal Cracked Naphtha (Petroleum): ORAL (LD50): Acute: > 5,000 mg/kg [Rat screen] - Somnolence, diarrhea, and hypermotility. GAS (LC50): Acute: > 5,740 mg/L for 4 hours [Rat screen level] - Somnolence. DERMAL (LD50): Acute: > 2,000 mg/kg [Rabbit screen level].
	n-Heptane: GAS (LC50): Acute: 103,000 mg/m ³ for 4 hours [Rat] - Convulsions. DERMAL (LD50): Acute: > 2,000 mg/kg [Rabbit]. INTRAVENOUS (LD50): Acute: 222 mg/kg [Mouse].

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

Benzene:

ORAL (LD50): Acute 930 mg/kg [Rat] - Tremors and convulsions
 ORAL (LD50): Acute 4,700 mg/kg [Mouse].
 ORAL (LD50) Acute: 5,700 mg/kg [Unidentified mammal]
 GAS (LC50) Acute: 10,000 ppm for 7 hours [Rat].
 GAS (LC50) Acute 9,980 ppm for 8 hours [Mouse] - General anesthesia, muscle weakness, and
 dyspnea
 DERMAL (LD50) Acute 48 mg/kg [Mouse].
 DERMAL (LD50). Acute > 9,400 uL/kg [Rabbit and Guinea Pig]
 INTRAPERITONEAL (LD50) Acute: 340 mg/kg [Mouse].
 INTRAPERITONEAL (LD50) Acute 2,890 ug/kg [Rat] - Lung and liver damage plus
 decreased blood cells

Toluene:

ORAL (LD50): Acute. 636 mg/kg [Rat].
 ORAL (LD50): Acute: 4,000 mg/kg [Cat].
 GAS (LC50). Acute: 49,000 mg/m³ for 4 hours [Rat].
 GAS (LC50) Acute: 5,320 ppm for 8 hours [Mouse].
 GAS (LC50): Acute: 400 ppm for 24 hours [Mouse]
 DERMAL (LD50): Acute. 14,100 uL/kg or 12,125 mg/kg [Rabbit]
 INTRAVENOUS (LD50). Acute 1,960 mg/kg [Rat]
 INTRAVENOUS (LD50): Acute: 2,000 mg/kg [Mouse]
 SUBCUTANEOUS (LD50) Acute: 2,250 mg/kg [Mouse]
 INTRAPERITONEAL (LD50). Acute 59 mg/kg [Mouse].
 INTRAPERITONEAL (LD50) Acute 500 mg/kg [Guinea Pig]
 INTRAPERITONEAL (LD50). Acute 1,332 mg/kg [Rat].

Methylcyclohexane:

ORAL (LD50) Acute: 2,250 mg/kg [Mouse]
 GAS (LC50) Acute. 41,500 mg/m³ for 2 hours [Mouse] - Hypermotility and diarrhea
 GAS (LC50). Acute 15,227 ppm for 1 hour [Rabbit] - General anesthetic, convulsions,
 and changes in the salivary glands

n-Octane:

GAS (LC50): Acute 118,000 mg/m³ for 4 hours [Rat].

Xylenes:

ORAL (LD50): Acute: 4,300 mg/kg [Rat].
 GAS (LC50): Acute: 4,550 ppm for 4 hours [Rat].
 DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit]
 SUBCUTANEOUS (LD50): Acute 1,700 mg/kg [Rat].
 INTRAPERITONEAL (LD50): Acute: 2,459 mg/kg [Rat]
 INTRAPERITONEAL (LD50): Acute: 1,548 mg/kg [Mouse].

Ethylbenzene:

ORAL (LD50): Acute: 3,500 mg/kg [Rat].
 DERMAL (LD50). Acute: 17,800 uL/kg [Rabbit].
 INTRAPERITONEAL (LD50). Acute 2,624 mg/kg [Rat].

n-Nonane:

GAS (LC50): Acute: 3,200 ppm for 4 hours [Rat]
 INTRAVENOUS (LD50): Acute: 218 mg/kg [Mouse]

Trimethylbenzenes:

ORAL (LD50): Acute. 8,970 mg/kg [Rat]

1,2,4-Trimethylbenzene:

ORAL (LD50): Acute: 5,000 mg/kg [Rat].
 GAS (LC50): Acute: 18,000 mg/m³ for 4 hours [Rat].

Ethylmethylbenzenes (Ethyltoluenes):

GAS (LC50): Acute: 50,000 mg/m³ for 2 hours [Cat]
 GAS (LC50): Acute 54,000 mg/m³ for 4 hours [Mouse]

Indene:

ORAL (LD50): Acute: 2,300 mg/kg [Rat]
 ORAL (LD50) Acute: 1,800 mg/kg [Mouse]
 GAS (LC50). Acute: 14,000 mg/m³ for 4 hours [Rat].

Naphthalene:

ORAL (LD50). Acute: 490 mg/kg [Rat].
 ORAL (LD50): Acute: 533 mg/kg [Mouse].
 ORAL (LD50): Acute 1,200 mg/kg [Guinea Pig].
 SUBCUTANEOUS (LD50): Acute: 969 mg/kg [Mouse].
 INTRAVENOUS (LD50) Acute: 100 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 150 mg/kg [Mouse].

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

Subchronic (28-day) oral and dermal studies with **heavy thermal cracked naphtha (petroleum)** using rats and rabbits showed animal weight loss or reduced weight gain, renal tubule changes and acute tubular necrosis, plus slight to moderate skin irritation without sensitization. Heavy catalytic cracked naphtha also produced equivocal mutagenic responses in the Salmonella/microsome (Ames) Assay and positive responses in the in-vitro Mouse Lymphoma Assay with and without S9 activation. The significance of these animal mutagenicity study results to human health is unclear.

Long-term mouse skin painting studies sponsored by the American Petroleum Institute (API) showed **heavy thermal cracked naphtha** caused a slight increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). Average latency period was 72 weeks. A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of similar and heavier **petroleum distillates**.

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. If ingested, benzene's lethal dose for a normal human adult is one teaspoon to one ounce (~10 mL). Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children/teenagers have less resistance.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by inhalation and dermal exposure and repeated direct skin application can produce defatting dermatitis. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (< 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

2,2,4-Trimethylpentane (Iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic, nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

NTP completed a 2-year inhalation bioassay of **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

Rats inhaling *n*-nonane at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given *n*-nonane for 2 to 7 days.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. Its TC_{L_50} for humans 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation studies with rats, four of ten animals died after exposures of 2,400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. Mesitylene (1,3,5-Trimethylbenzene) inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Indene and ethylmethylbenzenes are primary skin irritants. Overexposure has been associated with kidney damage and increased blood cholinesterase levels. In inhalation developmental studies, these and other C9 aromatic hydrocarbons have been associated with decreased fetal and newborn pup weights.

Naphthalene is a potential irritant to eyes, skin and lungs. Ingestion of naphthalene has been associated with severe red blood cell and liver damage leading to death. Following prolonged or repeated exposures, naphthalene has been shown to cause cataracts, optical neuritis, hemolytic and aplastic anemia, kidney damage (jaundice), and possibly neurotoxicity. In animal studies, naphthalene caused fetal effects and decreased spleen weights in pregnant female mice. In an NTP sponsored study, naphthalene produced a dose related increase in tumors at the 30 and 60 ppm exposure level in both male and female rats. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas and non-neoplastic lesions of the nose were observed as compared to controls. Cytogenic studies with Chinese hamster ovary cells have demonstrated sister chromatid exchanges and chromosomal aberrations. The relevance of these studies to human health is unclear.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Volatile aromatic hydrocarbon components (benzene, toluene, xylenes, ethylbenzene, cumene, and trimethylbenzenes) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 20 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 60 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), Guppy (*Lebistes reticulatus*) and juvenile American Shad (*Squalius cephalus*) in fresh water. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and toxicity (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Octanes, Nonanes)		
Hazard Class	DOT Class: 3 (Flammable liquid).	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this product which might require DOT HAZMAT bill-of-lading display are Xylenes and Benzene.		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	All impacted components were delisted as DOT "Marine Pollutants" per 66 FR 120 (page 33413) dated 6/21/2001.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.

Heavy Thermocracked Naphtha (C6-C12 Hydrocarbons)

SARA 313

This material might contain the following components in concentrations at or above de minimis levels and they are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313:

Benzene [CAS No. 71-43-2] concentration: 0.1 to 0.6%
Toluene [CAS No. 108-88-3] concentration: 1 to 5%
Xylenes [CAS No. 1330-20-7] concentration: 5 to 10%
Ethylbenzene [CAS No. 100-41-4] concentration: 1 to 2%
1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 95-63-6] concentration: 3 to 6%
Naphthalene [CAS No. 91-20-3] concentration: 0.5 to 1.5%

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are:

n-Hexane [CAS No. 110-54-3] (RQ = 5000 lbs. [2268 kg]) concentration: 0.1 to 0.9%
Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.1 to 0.9%
Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 0.9%
Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5%
2,2,4-Trimethylpentane (Iso-octane) [CAS No. 640-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 0.15 to 2.6%
Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 5 to 10%
Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 2%
Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0.001 to 0.25%
Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.5 to 1.5%

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

**California
Proposition 65**

This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5:

Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].

**New Jersey
Right-to-Know Label**

For New Jersey labeling, refer to the components listed in Section 2.

**Additional Regulatory
Remarks**

Under Section 12(b) of the Toxic Substances Control Act: Because it contains detectable amounts of **Cyclohexane [CAS No. 110-82-7]**, this product might be subject to US EPA's one-time only per country export notification requirements.

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Cyclohexane [CAS No. 110-82-7]**, **Benzene [CAS No. 71-43-2]**, **Methylcyclohexane [CAS No. 108-87-2]**, **Toluene [CAS No. 108-88-3]**, **Xylenes [CAS No. 1330-20-7]**, **Ethylbenzene [CAS No. 100-41-4]**, and **Cumene (Isopropylbenzene) [98-82-8]**.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 08/28/2002
Print Date Printed on 08/26/2002.

**Heavy Thermocracked Naphtha
(C6-C12 Hydrocarbons)****ABBREVIATIONS**

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
IARC: International Agency for Research on Cancer NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System
NFPA: National Fire Protection Association EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



Hydrodesulfurized Light Naphtha

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0112
Revision Date 9/8/2006

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Gas.
Color Colorless to light yellow.
Odor Hydrocarbon. Rotten eggs. (Strong.)

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source. May Contains Hydrogen Sulfide!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	4
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Hydrodesulfurized Light Naphtha (C4-C11 Hydrocarbons)	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	64742-73-0	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Sour Gas		
Synonyms	Hydrodesulfurized Light Naphtha (Petroleum), Light Hydrodesulfurized (HDS) Naphtha, HDS Light Naphtha, Treated Naphtha or Gasoline, Desulfurized Light Naphtha, C4-C11 Solvent, C4-C11 Naphtha.		

Hydrodesulfurized Light Naphtha

SECTION 2. COMPOSITION (TYPICAL)

Component Name(s)	CAS Registry No.	Concentration (%)
Heptane, all isomers	142-82-5	10 - 20
Pentanes	Mixture	10 - 20
Octanes, all isomers	Mixture	10 - 15
Hexane, other isomers	Mixture	5 - 15
Butane, all isomers	106-97-8	1 - 15
n-Hexane	110-54-3	5 - 10
Nonane, all isomers	Mixture	5 - 10
Methylcyclohexane	108-87-2	1 - 5
Xylene, all isomers	1330-20-7	1 - 5
C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	0.5 - 5
Cyclohexane	110-82-7	1 - 3
Toluene	108-88-3	1 - 3
Methylcyclopentane	96-37-7	1 - 3
Ethylmethylbenzene, all isomers	25550-14-5	1 - 2
Trimethylbenzenes, all isomers	25551-13-7	0.5 - 1.5
Cyclopentane	287-92-3	0.5 - 1.5
Benzene	71-43-2	<1
Ethylbenzene	100-41-4	0.2 - 1.3

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing this gas keeps the body from getting enough oxygen. Symptoms include dizziness, confusion, headache, and nausea. Continued breathing of this gas may lead to unconsciousness and death from suffocation. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness.
Eye Contact	Eye contact with compressed liquid or escaping gas can cause frostbite injury. This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.
Skin Contact	Certain components of this material can be absorbed through the skin and produce target organ effects. This material can be absorbed by the skin and produce central nervous system depression (headache, nausea, fatigue and/or other symptoms including unconsciousness). Skin contact may cause harmful effects in other parts of the body, and may cause death.
Ingestion	Ingestion is not an applicable route of exposure for gases.

Chronic Health Effects Summary This material (or a component) causes harm to the fetus including birth defects in humans. Prolonged or repeated overexposure to toluene, a component of this product, has been associated with reproductive effects in experimental animals and in long-term chemical abuse situations. Long-term overexposure to toluene has been associated with impaired color vision. Also, long-term overexposure to toluene in occupational environments have been associated with hearing damage. Repeated and prolonged overexposure to n-hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis. Benzene, a component of this product, causes blood disorders and damages the bone marrow (certain types of anemia, leukemia, and lymphoma). It is also capable of causing changes in living cells' genetic material (chromosomes). Benzene is considered to be a mutagen and a cancer-causing agent (leukemogen). Prolonged or repeated overexposure to xylene, a component of this product, has been associated with hearing damage in laboratory animals.

Hydrodesulfurized Light Naphtha

Conditions Aggravated by Exposure Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Exposure to high concentrations of this material may increase the sensitivity of the heart to epinephrine (adrenaline) and catecholamine-like drugs. (See Section 4, "Note to Physicians"). Respiratory System, Central Nervous System (CNS), Heart (Cardiac) Personnel with pre-existing central nervous system (CNS) disease, psychological conditions, skin disorders, impaired cardiovascular, liver, or kidney function, or chronic respiratory diseases should avoid exposure. Personnel with pre-existing skin, pulmonary, gastrointestinal, liver, kidney, or urinary disorders should avoid exposure.

Target Organs Contains material which may cause damage to the following organs: blood, kidneys, lungs, liver, mucous membranes, heart, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea, testes.

Carcinogenic Potential **CARCINOGENIC EFFECTS** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact If tissue is frozen, immediately seek medical attention. If tissue is not frozen, check for and remove contact lenses. Then, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure luke warm water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible. Do not use eye ointment unless directed by a physician.

Skin Contact In the event of frostbite or freeze burn, the affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water. Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.

Ingestion Due to the volatile nature of this material, ingestion is not a likely route of entry.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

Hydrodesulfurized Light Naphtha

Treat symptomatically.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.
Flash Point	Open cup: <-45°C (-49°F).
Lower Flammable Limit	AP 1 %
Upper Flammable Limit	AP 13 %
Autoignition Temperature	The lowest known value is 430°C (806°F) (Butane, all isomers).
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.
Special Properties	This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

Hydrodesulfurized Light Naphtha

SECTION 7. HANDLING AND STORAGE

Handling

DANGER: Poisonous and Flammable Gas. Do NOT breathe vapor; it contains hydrogen sulfide (H₂S). This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow escaping material to contact eyes or skin. Wear appropriate respiratory protection, protective work clothing, eye and face protection when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. Empty containers may still contain flammable and poisonous residue.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

Store sample cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F (38° C). Protect from dampness, salt or corrosive chemicals.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may be required in work areas to prevent accumulation of mixtures of gas and air that may ignite with explosive force. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling sampling cylinders, pressurized containers and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Use neoprene or PCV/nitrile gloves. When handling materials that can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves.

Hydrodesulfurized Light Naphtha

- Body Protection** Prevent potential skin contact with cold liquid or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Releases of this gas may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency, flammability and toxic gas levels. Odor is NOT adequate to warn of hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Heptane, all isomers	ACGIH (United States). TWA: 400 ppm 8 hour(s). STEL: 500 ppm 15 minute(s).
Pentanes	OSHA (United States). TWA: 500 ppm 8 hour(s). ACGIH (United States). TWA: 600 ppm 8 hour(s).
Octanes, all isomers	OSHA (United States). TWA: 1000 ppm 8 hour(s). ACGIH (United States). TWA: 300 ppm 8 hour(s).
Hexane, other isomers	OSHA (United States). TWA: 500 ppm 8 hour(s). ACGIH TLV (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
Butane, all isomers	ACGIH (United States). TWA: 800 ppm 8 hour(s).
n-Hexane	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Nonane, all isomers	ACGIH (United States). TWA: 200 ppm 8 hour(s).
Methylcyclohexane	ACGIH (United States). TWA: 400 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Xylene, all isomers	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Not available.
Cyclohexane	ACGIH (United States). TWA: 100 ppm 8 hour(s). OSHA (United States). TWA: 300 ppm 8 hour(s).
Toluene	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
Methylcyclopentane	Not available.

Hydrodesulfurized Light Naphtha

Ethylmethylbenzene, all isomers Trimethylbenzenes, all isomers	Not available. ACGIH (United States). TWA: 25 ppm 8 hour(s).
Cyclopentane	ACGIH (United States). TWA: 600 ppm 8 hour(s).
Benzene	ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Ethylbenzene	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas.	Color	Colorless to light yellow.	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	0.65 (Water = 1)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	-12°C (10.4°F)			Melting/Freezing Point	-160°C (-256°F)
Vapor Pressure	Not applicable.			Volatility	650 g/l VOC (w/v)
Solubility in Water	Partially soluble in cold water.			Viscosity (cSt @ 40°C)	not available
Flash Point	Open cup: <-45°C (-49°F).				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Hydrodesulfurized Light Naphtha

Toxicity Data

Heptane, all isomers

n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

Pentanes

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Butane, all isomers

Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause permanent peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Co-exposure to methylethyl ketone or methyl isobutyl ketone increases the neurotoxic properties of n-hexane. In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.

Xylene, all isomers

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse)

Hydrodesulfurized Light Naphtha

has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Trimethylbenzenes, all isomers

Studies of Workers:

Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. The TCLo for humans is 10 ppm, with somnolence and respiratory tract irritation noted.

Studies in Laboratory Animals:

In inhalation studies with rats, four of ten animals died after exposures of 2400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. Mesitylene (1, 3, 5 Trimethylbenzene) inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours.

Benzene

ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
 INHALATION (LC50):
 (VAPOR): Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs

Hydrodesulfurized Light Naphtha

following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD50), Acute: 3,500 mg/kg [Rat].

DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material.

Environmental Fate

An environmental fate analysis has not been conducted on this specific product. Releases are expected to cause significant immediate impact but only localized non-persistent environmental damage.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Material residues may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. If possible and permissible, this material may be disposed of as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

Hydrodesulfurized Light Naphtha

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Sudden Release of Pressure, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above <i>de minimis</i> levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: No components were identified.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: 7.5% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 3% Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lbs. (453.6 kg) Concentration: 2% Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: 2% Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: 0.9% Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: 0.75%
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Toluene: 2% Benzene: 0.9% Ethylbenzene: 0.75%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

Hydrodesulfurized Light Naphtha

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 5.0
Revision Date 9/8/2006
Print Date Printed on 9/8/2006.

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist AIHA: American Industrial Hygiene Associator
IARC: International Agency for Research on Cancer NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System
NFPA: National Fire Protection Association EPA: US Environmental Protection Agency

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0113
Revision Date 10/2/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent, colorless to slightly yellow. **Odor** Moderate, sweet and pleasant, aromatic hydrocarbon.

DANGER!

Highly flammable liquid; vapor may cause flash fire.
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.
Liquid contact may cause mild to moderate eye and/or moderate to severe skin irritation and inflammation.
May be harmful if inhaled or absorbed through the skin.
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects.
May be harmful or fatal if ingested.
Aspiration into the lungs can cause pulmonary edema and chemical pneumonia.
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats).
Potential cancer hazard.
Contains Ethylbenzene and Naphthalene.
May cause blood disorders and kidney and/or liver damage.
Mutagenic hazard; may cause genetic damage.
May adversely affect reproduction or reproductive development.
Spills may create a slipping hazard.

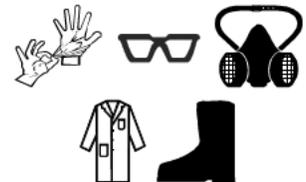
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	064742821*	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	64742-82-1	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	C7-C12 Petroleum Hydrocarbons		
Synonyms	Heavy HDS Naphtha; Heavy HDS Gasoline; 632 HDS Unit LEF Bottoms; HDS Light Ends Fractionation Tower Bottoms; 735 Magnaformer Feedstock; High-Octane Gasoline Blending Component; OP-400 Blend Stock; Heavy Hydrodesulfurized Naphtha (Petroleum); HHDSN.		

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Heavy Hydrodesulfurized Naphtha (Petroleum)	64742-82-1	100
2) Heptanes	Mixture	5-15
3) Methylcyclohexane	108-87-2	1-5
4) Toluene	108-88-3	1-5
5) Octanes	Mixture	15-30
6) Xylenes (Mixed Isomers)	1330-20-7	5-15
7) Ethylbenzene	100-41-4	1-5
8) Nonanes	Mixture	15-25
9) n-Propylbenzene	103-65-1	0.5-2
10) Trimethylbenzenes	25551-13-7	5-10
11) 1,2,4-Trimethylbenzene (Pseudocumene)	95-63-6	2.5-5
12) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-10
13) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	5-10
14) Naphthalene	91-20-3	0.1-0.9
15) C10-C12 Alkylbenzenes	70693-06-0	1-5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this material can cause minimal to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials and components suggest that this material can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary	Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline/naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this product may be harmful or fatal.
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Toluene may cause a weak cardiac sensitization to epinephrine (adrenalin)-like drugs. Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational **toluene and xylene** exposures have caused auditory nerve degeneration.

At high exposure concentrations, **ethylbenzene** has been associated with multiple organ tumors in laboratory animals.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylene isomers and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. And, the **C9 aromatic hydrocarbons (cumene, n-propylbenzene, trimethylbenzenes, indene, and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period.

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic. (See Section 11.)

Conditions Aggravated by Exposure	Personnel with pre-existing central nervous system (CNS) disease, psychological conditions, skin disorders, impaired hearing, cardiovascular, liver, or kidney function, blood disorders, or chronic respiratory diseases should avoid exposure.
Target Organs	The substance is toxic to lungs, central nervous system, especially the auditory nerves, brain, blood, kidneys, liver, heart, thymus, mucous membranes, skin, eyes, and possibly the reproductive system.
Carcinogenic Potential	This material contains ethylbenzene and naphthalene at concentrations above 0.1%. Ethylbenzene and naphthalene are considered possibly carcinogenic to humans by IARC and "A3 Animal Carcinogens" by ACGIH. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IB Flammable Liquid. Highly flammable!		
Flash Point Method	CLOSED CUP: -6° to -4°C (21° to 25°F) (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 0.9%	Upper Flammable Limit	AP 7.6%
Autoignition Temperature	AP 232°C (450°F) [ASTM E-659]		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	<p>Flammable Liquid! This material releases vapors at or approaching its flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard's potential, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding. (See American Petroleum Institute Publication 2003).</p>		
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>		
Protection of Fire Fighters	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify authorities if liquid(s) enter sewers or waterways.</p>		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store other toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection	Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.
Hand Protection	Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, Silver Shield®, PVC/NBR, or fluoroelastomers such as Viton® or Teflon®). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
Body Protection	Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).
General Comments	Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
2) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
3) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
4) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL)
5) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
6) Xylenes (Mixed Isomers)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 100 (ppm) from OSHA (PEL)
7) Ethylbenzene ("A3" Animal Carcinogen)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [Proposed] TWA: 100 (ppm) from OSHA (PEL)
8) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) TWA: 200 (ppm) from OSHA (PEL) [Proposed]
9) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) TWA: 25 (ppm) from OSHA (PEL) [Proposed]
10) Naphthalene ("A3" Animal Carcinogen [Proposed])	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed] TWA: 10 (ppm) from OSHA (PEL)

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color Transparent, colorless to slightly yellow.	Odor	Moderate, sweet and pleasant, aromatic hydrocarbon.
Specific Gravity	0.80 to 0.83 (Water = 1)	pH Not applicable.	Vapor Density	3.5 to 4.0 (Air = 1)
Boiling Point/Range	85° to 235°C (185° to 455°F) [ASTM D-2887]		Melting/Freezing Point	< -70°C (< -95°F) [ASTM D-97]
Vapor Pressure	2 to 5 mm Hg at 20°C (68°F) or 1.0 to 2.0 Reid-psi at 100°F (37.8°C).		Viscosity (cSt @ 40°C)	1 to 3
Solubility in Water	Soluble in methanol and diethyl ether. Slightly soluble in cold water (< 0.05%).		Volatile Characteristics	Volatile Organic Compounds (VOCs) Content = 100%; 870 to 880 gm/L.
Additional Properties	Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 48 to 85.5 Wt.% [ASTM D-1319]; C7-C12 Aromatic Hydrocarbon Content = 14.5 to 52 Wt.% [ASTM D-1319]; Average Density at 60°F = 6.786 lbs./gallon [ASTM D-2161]; Dry Point Temperature = AP 437°F (225°C) [ASTM D-86]; Octane Rating = AP 89 [ASTM D-2885]; Sulfur Content = AP 0.01 Wt.% [ASTM D-2622 or D-1266]; Evaporation Rate = 0.5 to 1.7 when n-Butyl acetate = 1.0; Heat Value = 18,500 to 20,600 Btu.			

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data	Heavy Catalytic Reformate Naphtha (Petroleum) (a similar material): ORAL (LD50): Acute: 4,820 mg/kg [Rat males] - Somnolence, diarrhea, and hypermotility. ORAL (LD50): Acute: 5,040 mg/kg [Rat females] - Somnolence, diarrhea, and hypermotility. GAS (LC50): Acute: > 5,540 mg/L for 4 hours [Rat screen level] - No deaths; somnolence. DERMAL (LD50): Acute: > 2,000 mg/kg (Rabbit screen level). DRAIZE EYE: Acute: Mild to moderate eye irritant. [Rabbit]. DRAIZE DERMAL: Acute: Moderate to severe skin irritant. [Rabbit]. DERMAL (LD50): Acute: > 6,000 mg/kg [Rabbit screen level]. BUELER DERMAL: Acute: Non-sensitizing [Guinea Pig]. 28-Day DERMAL: Sub-Chronic: Moderate skin irritant at 200 mg/kg and severe skin irritant at 1,000 and 2,000 mg/kg [Rabbit]. MUTAGENICITY: Negative or equivocal responses for the modified Ames [Salmonella typhimurium], in vitro Lymphoma [Mouse] with and without S1 activation, and in vivo Bone Marrow Cytogenetics [Rat] assays. n-Heptane: GAS (LC50): Acute: 103,000 mg/m ³ for 4 hours [Rat] - Convulsions. DERMAL (LD50): Acute: > 2,000 mg/kg [Rabbit].
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Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

INTRAVENOUS (LD50): Acute: 222 mg/kg [Mouse].

INTRAPERITONEAL (LD50): Acute: 150 mg/kg [Mouse].

Methylcyclohexane:

ORAL (LD50): Acute: 2,250 mg/kg [Mouse].

GAS (LC50): Acute: 41,500 mg/m³ for 2 hours [Mouse] - Hypermotility and diarrhea.

GAS (LC50): Acute: 15,227 ppm for 1 hour [Rabbit] - General anesthetic, convulsions,
and changes in the salivary
glands.

Toluene:

ORAL (LD50): Acute: 636 mg/kg [Rat].

ORAL (LD50): Acute: 4,000 mg/kg [Cat].

GAS (LC50): Acute: 49,000 mg/m³ for 4 hours [Rat].

GAS (LC50): Acute: 5,320 ppm for 8 hours [Mouse].

GAS (LC50): Acute: 400 ppm for 24 hours [Mouse].

DERMAL (LD50): Acute: 14,100 uL/kg or 12,125 mg/kg [Rabbit].

INTRAVENOUS (LD50): Acute: 1,960 mg/kg [Rat].

INTRAVENOUS (LD50): Acute: 2,000 mg/kg [Mouse].

SUBCUTANEOUS (LD50): Acute: 2,250 mg/kg [Mouse].

INTRAPERITONEAL (LD50): Acute: 59 mg/kg [Mouse].

INTRAPERITONEAL (LD50): Acute: 500 mg/kg [Guinea Pig].

INTRAPERITONEAL (LD50): Acute: 1,332 mg/kg [Rat].

n-Octane:

GAS (LC50): Acute: 118,000 mg/m³ for 4 hours [Rat].

Xylenes:

ORAL (LD50): Acute: 4,300 mg/kg [Rat].

GAS (LC50): Acute: 4,550 ppm for 4 hours [Rat].

DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit].

SUBCUTANEOUS (LD50): Acute: 1,700 mg/kg [Rat].

INTRAPERITONEAL (LD50): Acute: 2,459 mg/kg [Rat].

INTRAPERITONEAL (LD50): Acute: 1,548 mg/kg [Mouse].

Ethylbenzene:

ORAL (LD50): Acute: 3,500 mg/kg [Rat].

DERMAL (LD50): Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50): Acute: 2,624 mg/kg [Rat].

n-Nonane:

GAS (LC50): Acute: 3,200 ppm for 4 hours [Rat].

INTRAVENOUS (LD50): Acute: 218 mg/kg [Mouse].

INTRAPERITONEAL (LD₅₀): Acute: 150 mg/kg [Mouse].

n-Propylbenzene:

ORAL (LD50): Acute: 6,040 mg/kg [Rat].

GAS (LC50): Acute: 65,000 ppm for 2 hours [Rat].

Trimethylbenzenes:

ORAL (LD50): Acute: 8,970 mg/kg [Rat].

1,2,4-Trimethylbenzene:

ORAL (LD50): Acute: 5,000 mg/kg [Rat].

GAS (LC50): Acute: 18,000 mg/m³ for 4 hours [Rat].

Ethylmethylbenzenes (Ethyltoluenes):

GAS (LC50): Acute: 50,000 mg/m³ for 2 hours [Cat].

GAS (LC50): Acute: 54,000 mg/m³ for 4 hours [Mouse].

n-Decane:

GAS (LC50): Acute: 72,300 mg/m³ for 2 hours [Mouse].

Naphthalene:

ORAL (LD50): Acute: 490 mg/kg [Rat].

ORAL (LD50): Acute: 533 mg/kg [Mouse].

ORAL (LD50): Acute: 1,200 mg/kg [Guinea Pig].

Subchronic (28-day) dermal studies with **heavy catalytic reformed naphtha (petroleum)** using rabbits showed animal weight loss or reduced weight gain, renal tubule changes and acute tubular necrosis, plus moderate to severe skin irritation without sensitization. Heavy catalytic reformed naphtha also produced negative or equivocal responses mutagenic responses in series of various assays. The significance of these animal mutagenicity study results to human health is unclear.

Long-term mouse skin painting studies sponsored by the American Petroleum Institute (API) showed **heavy catalytic reformed naphtha (petroleum)** did not produce any increased incidence of benign skin

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). Average latency period was 80 weeks. All animals survived throughout the study. A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of similar and heavier **petroleum distillates**.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by inhalation and dermal exposure and repeated direct skin application can produce defatting dermatitis. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (< 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for one hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for six hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD₅₀ somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for six hours per day, five days per week, for three weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (Iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

NTP completed a 2-year inhalation bioassay of **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Prolonged and/or repeated overexposure to **cumene (isopropylbenzene)** via inhalation or skin absorption can cause liver and/or kidney damage.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. Its TC_{L_0} for humans 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation studies with rats, four of ten animals died after exposures of 2,400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. **Mesitylene (1,3,5-Trimethylbenzene)** inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Ethylmethylbenzenes are primary skin irritants and overexposures might cause liver and/or kidney

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

damage or increase blood cholinesterase levels. Inhalation of these and other **C9 aromatic hydrocarbons** by pregnant mice and rats during gestational days 6 through 15 resulted in decreased fetal and newborn weights.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction or red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in eight of 21 workers exposed to elevated levels of naphthalene vapors for five years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Based upon animal studies, naphthalene may cause fetal toxicity or damage and decreased spleen weights in pregnant female mice.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay of **naphthalene**. The study was conducted in male and female F344/N rats at exposure concentrations of 0, 10, 30, and 60 ppm. No significant effects were observed at the 10 ppm levels. However, compared to chamber controls, there was a dose-related increase in tumors generated at the 30 and 60 ppm levels in both males and females. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas, and non-neoplastic lesions of the nose were observed when compared to chamber controls. Additionally, in cytogenic tests with Chinese hamster ovary cells, naphthalene induced significant increases in sister chromatid exchanges with and without metabolic activation (S9) and chromosomal aberrations with S9. The relevance of these findings to human health is unclear; however, based upon this data, the IARC has determined naphthalene to be possibly carcinogenic to humans (Class 2B).

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Volatile **aromatic hydrocarbon components (toluene, xylenes, ethylbenzene, cumene, indene, trimethylbenzenes, and naphthalene)** may be released and possibly contribute to the creation of atmospheric smog. **Toluene** has a half-life of from 3 hours to slightly over 1 day when hydroxyl radicals are present.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 60 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), Guppy (*Lebistes reticulatus*) and juvenile American Shad (*Squalius cephalus*) in fresh water. Also, 24-hour and 96-hour LC50s for **toluene** produced results from 25 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), toluene showed 24-hour TLms of from 100 ppm to 200 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated with this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (U220) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Octanes, Nonanes)		
Hazard Class	DOT Class: 3 (Flammable liquid).	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this material which may require DOT HAZMAT bill-of-lading display are Xylenes and Toluene or 2,2,4-Trimethylpentane (Iso-octane) or Ethylbenzene.		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	All impacted components were delisted as DOT "Marine Pollutants" per 66 FR 120 (page 33413) dated 6/21/2001.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) Inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)**Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.****SARA 313**

This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313:

Toluene [CAS No. 108-88-3] concentration: 1 to 5%
Xylenes [CAS No. 1330-20-7] concentration: 5 to 15%
Ethylbenzene [CAS No. 100-41-4] concentration: 1 to 5%
Cumene (Isopropylbenzene) [CAS No. 92-82-8] concentration: 0.1 to 0.9%
1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 95-63-6] concentration: 2.5 to 5%
Naphthalene [CAS No. 91-20-3] concentration: 0.1 to 0.9%.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are:

Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5%
2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 1 to 10%
Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 5 to 15%
Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5%
Cumene [CAS No. 92-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0.1 to 0.9%
Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 0.9%.

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

**California
Proposition 65**

This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: **Toluene [CAS No. 108-88-3] and Naphthalene [CAS No. 91-20-3].**

**New Jersey
Right-to-Know Label**

For New Jersey labeling, refer to the components listed in Section 2.

**Additional Regulatory
Remarks**

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Toluene (CAS No. 108-88-3), Xylenes (mixed) (CAS No. 1330-20-7), Ethylbenzene (CAS No. 100-41-4), and Cumene (Isopropylbenzene) (CAS No. 98-82-8).**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 10/2/2002
Print Date Printed on 10/3/2002.

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
 ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
 IARC: International Agency for Research on Cancer NTP: National Toxicology Program
 NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
 NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons)

NFPA: National Fire Protection Association

EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Straight-run Naphtha (C4-C11 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0114
Revision Date 09/07/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquefied Gas/Liquid
Color Transparent, colorless **Odor** Light hydrocarbon

DANGER! Extremely flammable gas/liquid;
vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
High concentrations of vapor reduce oxygen available for breathing!
Mist or vapor may irritate the eyes, mucous membranes, and/or respiratory tract!
Liquid contact may cause minimal to moderate eye irritation and/or mild to severe skin irritation or frostbite to freeze burns!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss, and/or liver, kidney, or peripheral nervous system damage!
May be harmful or fatal if ingested! Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Potential cancer hazard! Contains low levels of Benzene!
May cause leukemia and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
Based upon animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Straight-run Naphtha (C4-C11 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	064741420*	Medical Emergency	(918) 495-4700
CAS Number	64741-42-0	CHEMTREC Emergency	(800) 424-9300
Product Family	C4-C11 Petroleum Hydrocarbons		
Synonyms	Full-range Straight-run Naphtha (Petroleum), Crude Distillation Unit Full-range Naphtha; Refinery Crude Tower Naphtha; Raw Gasoline; Untreated Naphtha or Gasoline, C4-C11 Solvent; C4-C11 Naphtha		

Straight-run Naphtha (C4-C11 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Full-range Straight-run Naphtha (Petroleum)	64742-89-8	100
2) Butanes	Mixture	1-15
3) Pentanes	Mixture	10-20
4) Cyclopentane	287-92-3	0.5-1.5
5) Hexane Isomers	Mixture	5-15
6) Methylcyclopentane	96-37-7	1-3
7) n-Hexane	110-54-3	5-10
8) Cyclohexane	110-82-7	1-3
9) Benzene	71-43-2	0.1-0.9
10) Heptanes	Mixture	10-20
11) Methylcyclohexane	108-87-2	1-5
12) Toluene	108-88-3	1-3
13) Octanes	Mixture	10-15
14) Xylene, Mixed Isomers	1330-20-7	1-5
15) Ethylbenzene	100-41-4	0.2-1.3
16) Nonanes	Mixture	5-10
17) Trimethylbenzene (mixed isomers)	25551-13-7	0.5-1.5
18) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-2
19) C10 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	1-3
20) C11 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	0.5-2

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Components of this liquefied gas/naphtha may produce mild narcotic effects. High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Breathing vapors may also cause upper respiratory tract irritation and/or central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon level of concentration and/or duration of exposure. Approximately 20,000 ppm (or 2 vol.%) of the vapor in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 to 10,000 ppm for only 5 minutes.
Eye Contact	Direct contact with the pressurized or liquefied gas portion of this material may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Animal test results on similar materials and actual human exposures suggest that this product can cause minimal to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Direct contact with the liquefied/pressurized gas portion of this material may produce severe and possibly permanent skin damage from frostbite or freeze burns. Animal test results on similar substances and its components suggest that this material can cause mild to severe skin irritation. Short-term contact symptoms include redness, itching, and burning or blistering of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas/naphtha. However, if swallowed, this material may cause a "freeze burn" or irritation with a burning sensation of the mucous membranes in the mouth, throat, and esophagus. The liquid portion of this material can be readily absorbed by the stomach and intestinal tract. Symptoms include nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).
	Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Straight-run Naphtha (C4-C11 Hydrocarbons)

Chronic Health Effects Summary

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational **toluene** and **xylene** exposures have caused auditory nerve degeneration.

Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Also, reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). Intentional misuse by deliberately concentrating and inhaling this material may be harmful or fatal.

Even with acute exposures, **n-hexane** is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, **2,5-hexanedione**, has been shown to cause degeneration of the testes.

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylenes and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. And, the **C9 aromatic hydrocarbons (trimethylbenzenes and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing nervous system disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material. They should take additional precautions to minimize or avoid exposure.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

The substance is toxic to lungs, nervous system, especially the auditory and peripheral nerves, brain, mucous membranes, skin, eyes, and possibly, the heart, blood, liver, kidneys, thymus, and reproductive systems.

Carcinogenic Potential

This stream contains benzene at concentrations above 0.1%. **Benzene** is considered carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Straight-run Naphtha (C4-C11 Hydrocarbons)

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F) DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.</p> <p>If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p> <p>Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable!		
Flash Point/Method	CLOSED CUP: -43° to -37°C (-45° to -35°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.1 %	Upper Flammable Limit	AP 7.6 %
Auto-Ignition Temp.	AP 232°C (450°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors		
Special Properties	Extremely Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		

Straight-run Naphtha (C4-C11 Hydrocarbons)

Extinguishing Media

SMALL FIRE Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). **LARGE FIRE:** Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. **NEVER** use a water jet directly on the fire because it may spread the fire to a larger area

Fire Fighting Protective Clothing

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas/Naphtha! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors

Caution: Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safely stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of its vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Odor is an inadequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Do not allow vaporizing material to contact eyes, skin, or other tissues. Never siphon by mouth. Prevent contact with food, chewing, or smoking materials. Do not take internally.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of gas/naphthas. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Straight-run Naphtha (C4-C11 Hydrocarbons)

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below), then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gas/liquid mixtures. If this material is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Suitable eye wash water should be readily available.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gas/liquid mixtures. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas/naphtha may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Straight-run Naphtha (C4-C11 Hydrocarbons)

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1999] TWA: 1000 (ppm) from OSHA (PEL) [1989]
2) Gasoline ("A3" Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 500 (ppm) from OSHA (PEL) [1989]
3) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
4) Butane	TWA: 800 (ppm) from ACGIH (TLV) [1999] TWA: 800 (ppm) from OSHA (PEL) [1989]
5) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) [1999] TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [1989] TWA: 1000 (ppm) from OSHA (PEL) [1976]
6) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) [1999] TWA: 600 (ppm) from OSHA (PEL) [1989]
7) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [1999] TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [1989]
8) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 50 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
9) Cyclohexane	TWA: 300 (ppm) from ACGIH (TLV) [1999] TWA: 200 STEL: 400 (ppm) from ACGIH (TLV) [Proposed for 2000] TWA: 300 (ppm) from OSHA (PEL) [1976]
10) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
11) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) [1999] TWA: 400 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
12) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
13) Toluene ("A4" = Not Classifiable)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
14) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
15) Xylene, Mixed Isomers ("A4" = Not Classifiable)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989]
16) Ethylbenzene ("A3" Animal Carcinogen)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [1989]
17) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) [1999] TWA: 200 (ppm) from OSHA (PEL) [1989]
18) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) [1999] TWA: 25 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas/Liquid. Color Transparent, colorless. Odor Light hydrocarbon
Specific Gravity	0.71-0.75 pH Not applicable. Vapor Density 2.5-3.0 (Air = 1) (Water = 1)
Boiling Point/Range	-20° to 204°C (-4° to 400°F) Melting/Freezing Point -160° to 7°C (ASTM D-2887) (-256° to 45°F)
Vapor Pressure	AP 150 mm Hg at 20°C (68°F) or Viscosity (cSt @ 40°C) 0.5 to 2 10 to 20 Reid-psia at 40°C (104°F)
Solubility in Water	Slightly soluble in cold water (AP 0.1%). Volatile Characteristics Volatile Organic Compounds (VOCs) Content = 100%; AP 700 gm/L. This material is usually stored as a liquid If open to the atmosphere, it will evaporate quickly to form a vapor cloud

Straight-run Naphtha (C4-C11 Hydrocarbons)

Additional Properties Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 80 to 95 Wt % (ASTM D-1319),
C6-C10 Aromatic Hydrocarbons Content = 4 to 14 Wt.% (ASTM D-1319),
Olefin Hydrocarbons Content = 1 to 6 Wt.% (ASTM D-1319);
Average Density at 60°F = 6.077 lbs./gal. (ASTM D-2161);
Dry Point Temperature = 383°F (195°C) (ASTM D-86);
Evaporation Rate = 9 to 15 when n-Butyl acetate = 1.0;
Heat Value = 16,500 to 17,500 Btu.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability Stable **Hazardous Polymerization** Not expected to occur.

Conditions to Avoid Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.

Materials Incompatibility Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen. n-Heptane will dissolve some plastics

Hazardous Decomposition Products No substances are readily identified from composition, but, no degradation data is available.

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

When a 4-hour rabbit inhalation screen test was run on liquefied petroleum gas, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An n-butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, n-pentane caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of isobutane and n-butane in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of isobutane may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of butane and butylenes (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone

Inhalation of 500 ppm of isopentane or n-pentane have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of n-pentane for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both isopentane and n-pentane using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths

Intentional sniffing abuse of n-hexane has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to n-hexane, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (polyneuropathy). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane may be increased by concurrent exposure to methyl ethyl ketone, methyl isobutyl ketone, and/or toluene.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic. n-Hexane is NOT a tumor promoter in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. n-Hexane, or its metabolite 2,5-hexanedione, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.

Straight-run Naphtha (C4-C11 Hydrocarbons)

Cyclohexane is an eye, skin, and mucous membrane irritant, CNS depressant, and causes narcosis at high concentrations in air. There is a narrow margin between narcosis, loss of reflexes, and death. In experimental animals exposed to lethal concentrations by inhalation or oral route, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys, and brain. Cyclohexane does not act as a promoter for tumors on mice when exposed to dimethylbenzanthracene, and, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation; however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is irritating to skin and readily absorbed by either inhalation or dermal exposure. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. Repeated direct skin application can produce defatting dermatitis. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (LT 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Straight-run Naphtha (C4-C11 Hydrocarbons)

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay on **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. NTP, IARC, and OSHA have not designated ethylbenzene as a carcinogen.

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Ethylmethylbenzenes are primary skin irritants and overexposures might cause liver and/or kidney damage or increase blood cholinesterase levels. Inhalation of these and other **C9 aromatic hydrocarbons** by pregnant mice and rats during gestational days 6 through 15 resulted in decreased fetal and newborn weights.

Straight-run Naphtha (C4-C11 Hydrocarbons)

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This material will normally evaporate rapidly if spilled. If released, volatile aromatic hydrocarbon components (benzene, toluene, xylenes, and ethylbenzene) may contribute to the creation of atmospheric smog. The atmospheric half-lives of the butanes under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of isobutane and n-butane in air (LT 8%) is not considered to be environmentally significant. Isopentane, n-pentane, n-hexane, hexane isomers, n-heptane, heptane isomers, and iso-octane all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Toluene has a half-life of from 3 hours to slightly over 1 day and cyclohexane has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLM (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. 24-hour TLMs resulted in 2,990 ppm and 250 ppm when using Bluegill Sunfish (*Lepomis macrochirus*) and juvenile American Shad (*Squalius cephalus*), respectively. Also, 24-hour and 96-hour LC50s for cyclohexane and toluene produced results from 25 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), toluene showed 24-hour TLMs of from 100 ppm to 200 ppm. Using Mosquito Fish (*Gambusia affinis*), cyclohexane showed a 24-hour TLM of 15,500 ppm and n-heptane showed a 24-hour TLM of 4,925 ppm and a LC100 of 10,000 ppm in turbid fresh water. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Straight-run Naphtha
(C4-C11 Hydrocarbons)**

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n o s (Hexanes, Pentanes or Heptanes)		
Hazard Class	Class 3: Flammable liquid.	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this product which might require DOT HAZMAT bill-of-lading display are Xylenes and Benzene .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: n-Hexane [CAS No. 110-54-3] concentration: 5 to 10% Cyclohexane [CAS No. 110-82-7] concentration: 1 to 3% Benzene [CAS No. 71-43-2] concentration: 0.1 to 0.9% Toluene [CAS No. 108-88-3] concentration: 1 to 3% Xylenes [CAS No. 1330-20-7] concentration: 1 to 5% Ethylbenzene [CAS No. 100-41-4] concentration: 0.2 to 1.3%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this product which are subject to this statute are: n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 5 to 10% Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 3% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 0.9% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 3% 2,2,4-Trimethylpentane (iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 1 to 5% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 5% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.2 to 1.3% Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0 to 0.25%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA) Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

Straight-run Naphtha (C4-C11 Hydrocarbons)

California Proposition 65

This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5:

Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].

New Jersey Right-to-Know Label

For New Jersey labeling refer to components listed in Section 2.

Additional Regulatory Remarks

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of **Methylcyclopentane [CAS No. 96-37-7], Cyclohexane [CAS No. 110-82-7], n-Propylbenzene [CAS No. 103-65-1], Cumene [CAS No. 98-82-8], and other C9 Aromatic Hydrocarbons**, this product might be subject to US EPA's one-time only per country export notification requirements.

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Isopentane [CAS No. 78-78-4], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 71-43-2], Methylcyclohexane [CAS No. 108-87-2], Toluene [CAS No. 108-88-3], Xylenes [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], and Cumene (Isopropylbenzene) [CAS No. 98-82-8].**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Isobutane (Propane, 2-methyl), n-Butane, Isopentane (Butane, 2-methyl), and n-Pentane.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 4.0
Revision Date 09/07/1999
Print Date Printed on 10/08/1999.

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists			AIHA = American Industrial Hygiene Association			
IARC = International Agency for Research on Cancer			NTP = National Toxicology Program			
NIOSH = National Institute of Occupational Safety and Health			OSHA = Occupational Safety and Health Administration			
NPCA = National Paint and Coating Manufacturers Association			HMIS = Hazardous Materials Information System			
NFPA = National Fire Protection Association			EPA = Environmental Protection Agency			

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



FCCU Raw Gasoline

Material Safety Data Sheet

RS0116
HER# 340
732 FCCU
HAZCOM 1
MOUNT-2

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS 0116
Revision Date 4/12/2004

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 3	3
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Emergency Overview

Physical State

Color Colorless to light yellow. **Odor** Rotten eggs. (Hydrogen sulfide odor).

DANGER!

Extremely Flammable and Poisonous.

Contains hydrogen sulfide gas (H₂S). May be fatal if inhaled.

Vapor may cause flash fire or explosion.

Vapor may travel considerable distance to source of ignition and flash back.

Harmful or fatal if swallowed - Can enter lungs and cause damage.

Contains Benzene - Cancer Hazard. Can cause leukemia and other blood disorders.

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	FCCU Raw Gasoline	Technical Contact	(800) 525-4692
Product Number	RS 0116	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Refinery Intermediate Stream		
Synonyms	Full-Range Catalytic Cracked Naphtha (Petroleum); Full-Range Gasoline from a Fluid Catalytic Cracker Unit		

SECTION 2. COMPOSITION (TYPICAL)

Component Name(s)	CAS Registry No.	Concentration (%)
Light Catalytic Cracked Naphtha	64741-55-5	25-35
Heavy Catalytic Cracked Naphtha	64741-54-4	25-35
Xylene, all isomers	1330-20-7	5-10
C9 Aromatic Hydrocarbons	Mixture	1-5
Toluene	108-88-3	1-5
n-Hexane	110-54-3	0.5-5
Methane	74-82-8	0-5
Hydrogen	1333-74-0	0-5
Benzene	71-43-2	0.1-3
Cumene	98-82-8	0.1-1
Ethylbenzene	100-41-4	0.1-1
Hydrogen Sulfide	7783-06-4	0-1

FCCU Raw Gasoline

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

- Inhalation** May be harmful or fatal if inhaled. Contains hydrogen sulfide. Inhalation of gas or vapor may cause severe nose, throat, respiratory tract, and lung irritation, respiratory paralysis, and death, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.
- Eye Contact** This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.
- Skin Contact** May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.
- Ingestion** Swallowing this material may be harmful. Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea. This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).

- Chronic Health Effects Summary** Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea. Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers. Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis. This material, or a component of this material, has been shown to cause cancer in laboratory animals. However it is not likely to represent a human cancer hazard. See Toxicological Information (Section 11)

- Conditions Aggravated by Exposure** Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Respiratory System, Central Nervous System (CNS), Heart (Cardiac), Blood-forming system, auditory system
- Target Organs** May cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, adrenal, bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

- Carcinogenic Potential** **CARCINOGENIC EFFECTS** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified 2B (Possible for human.) by IARC [Ethylbenzene].

FCCU Raw Gasoline

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification NFPA Class-IB flammable liquid.

Flash Point Closed cup: Lower than -18°C (0°F).

Lower Flammable Limit AP 1 %

Upper Flammable Limit > 13 %

FCCU Raw Gasoline

Autoignition Temperature	The lowest known value is 480°C (896°F) (Toluene).
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and trace oxides of sulfur and/or nitrogen.
Special Properties	This gas is flammable at well below ambient temperatures and readily forms flammable mixtures with air. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

SECTION 7. HANDLING AND STORAGE

Handling A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of

FCCU Raw Gasoline

toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C). All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable regulatory requirements and the National Electrical Code.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact. Use gloves (e.g., disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.

Body Protection

Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.

Respiratory Protection

A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments

Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

FCCU Raw Gasoline

Benzene	<p>ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).</p>
Hydrogen Sulfide	<p>ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift</p>
C9 Aromatic Hydrocarbons	<p>ACGIH TLV (United States). TWA: 25 ppm 8 hour(s). Form: (Trimethylbenzene)</p>
n-Hexane	<p>ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).</p>
Toluene	<p>ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm</p>
Cumene	<p>ACGIH (United States). TWA: 50 ppm 8 hour(s). OSHA (United States). Skin TWA: 50 ppm 8 hour(s).</p>
Xylene, all isomers	<p>ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).</p>
Ethylbenzene	<p>ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).</p>

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Color	Colorless to light yellow.	Odor	Rotten eggs. (Hydrogen sulfide odor).	
Specific Gravity	0.75 (Water = 1) (Estimated.)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	-128 to 455° C		Melting/Freezing Point	Not determined.	
Vapor Pressure	The highest known value is 2.9 kPa (22 mm Hg) (at 20°C) (Toluene). Weighted average: 1.61 kPa (12.08 mm Hg) (at 20°C)		Volatility	This material is usually stored as a liquid. If open to the atmosphere it will evaporate quickly to form a vapor cloud.	
Solubility in Water	Very slightly soluble in cold water. (<0.1 % w/w)		Viscosity (cSt @ 40°C)	Not determined.	
Additional Properties	No additional information.				

FCCU Raw Gasoline

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks and flame.		
Materials Incompatibility	Incompatible with strong acids, strong bases, and strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Benzene	
	ORAL (LD50):	Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
	INHALATION (LC50):	
	(VAPOR):	Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Xylene, all isomers**Effects from Acute Exposure:**

ORAL (LD50):	Acute: 4,300 mg/kg [Rat].
GAS (LC50):	Acute: 4,550 ppm for 4 hours [Rat].
DERMAL (LD50):	Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure.

FCCU Raw Gasoline

The relevance of these observations to humans is not clear at this time. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

C9 Aromatic Hydrocarbons

Embryotoxicity was reported in studies of laboratory animals. Adverse effects included increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Hydrogen Sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse].

Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations above 100 ppm are immediately dangerous to life and health.

Ethylbenzene

Effects from Acute Exposure:

ORAL (LD50), Acute: 3,500 mg/kg [Rat].

DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal

FCCU Raw Gasoline

exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity No data. Ecological effects testing has not been conducted on this material.

Environmental Fate This product is not expected to bioaccumulate through food chains in the environment.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitability (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.

**SARA 302/304
Emergency Planning
and Notification** The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

FCCU Raw Gasoline

SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Sudden Release of Pressure, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Benzene [CAS No.: 71-43-2] Concentration: 1.6% Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 7.5% Toluene [CAS No.: 108-88-3] Concentration: 3% Ethylbenzene [CAS No.: 100-41-4] Concentration: 0.6% n-Hexane [CAS No.: 110-54-3] Concentration: 2.8%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: 1.6% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 7.5% Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: 3% Hydrogen Sulfide [CAS No.: 7783-06-4] RQ = 100 lbs. (45.36 kg) Concentration: 0.5% Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: 0.55% Cumene [CAS No.: 98-82-8] RQ = 5000 lbs. (2268 kg) Concentration: 0.55% n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: 2.8%
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Benzene: 1.55% Toluene: 3%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.00
Revision Date 4/12/2004
Print Date Printed on 4/12/2004.

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienist AIHA: American Industrial Hygiene Association
IARC: International Agency for Research on Cancer NTP: National Toxicology Program

FCCU Raw Gasoline

NIOSH: National Institute of Occupational Safety and Health
NPCA: National Paint and Coating Manufacturers Association
NFPA: National Fire Protection Association

OSHA: Occupational Safety and Health Administration
HMIS: Hazardous Materials Information System
EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Naphtha/Hydrogen Mixed Phase Streams

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0119
Revision Date 09/12/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas, Liquefied Gas, and Liquid Mixture.		
Color	Transparent, colorless to slightly yellow liquid, invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure

DANGER! Extremely flammable and poisonous gas/liquid; vapor may cause flash fire or explosion.
High pressure and rapid diffusion hazard.
High vapor concentrations reduce oxygen available for breathing.
Contains Hydrogen Sulfide (H₂S).
May be harmful or fatal if inhaled or absorbed through the skin.
May cause central nervous system (CNS) depression or suffocation.
Compressed gas/liquid contact may cause frostbite/freeze burns.
Mist or vapor may cause mild to severe eye, skin, mucous membrane, and respiratory tract irritation and inflammation.
Aspiration into the lungs will cause pulmonary edema and chemical pneumonia.
Overexposures may cause central nervous system (CNS) depression and other target organ effects such as hearing loss and/or peripheral nerve damage.
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats).
Potential cancer hazard.
Contains Benzene, Ethylbenzene, and Naphthalene.
May cause leukemia and/or other blood disorders.
Mutagenic hazard; may cause genetic damage.
May adversely affect reproduction or reproductive development.
Spills may create a slipping hazard. Corrosive to some metals.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Naphtha/Hydrogen Mixed Phase Streams	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111111153	Medical Emergency	(918) 495-4700
CAS Number	Mixture (See Section 2.)	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Gas/Liquid Phase Mixture of a Full-range Naphthas		
Synonyms	HDS-Treated Full-range Reformate Naphtha, Reformate or HDS Naphtha With Hydrogen and Hydrogen Sulfide; Sour Liquefied Gas/Gasoline Mixture; 2-Phase Naphtha Reactor Mixture; Light Gas/Naphtha Mix Containing Some Hydrogen Sulfide; C4-C12 Hydrocarbons, Hydrogen, and H ₂ S.		

Naphtha/Hydrogen Mixed Phase Streams

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrogen sulfide	7783-06-4	0.1-1
2) Hydrogen	1333-74-0	20-40
3) Full-range Reformed Naphtha (Petroleum)	68919-37-9	0-60
4) Full-range Straight-run Naphtha (Petroleum)	64741-42-0	0-60
5) Hydrodesulfurized Light Naphtha (Petroleum)	64742-73-0	0-40
6) Hydrodesulfurized Heavy Naphtha (Petroleum)	64742-82-1	0-40
7) Propane	74-98-6	0-2
8) Butanes	Mixture	10-20
9) Pentanes	Mixture	10-25
10) Cyclopentane	287-92-3	0 5-5
11) Hexane Isomers	Mixture	10-25
12) Methylcyclopentane	96-37-7	0.1-3
13) n-Hexane	110-54-3	0 5-5
14) Cyclohexane	110-82-7	0 5-3
15) Benzene	71-43-2	0.1-3
16) Methylcyclohexane	108-87-2	0 5-5
17) Heptanes	Mixture	5-15
18) Toluene	108-88-3	1-5
19) Octanes	Mixture	1-10
20) Xylenes (Mixed Isomers)	1330-20-7	1-10
21) Ethylbenzene	100-41-4	0.2-2.5
22) Nonanes	Mixture	1-10
23) Trimethylbenzene (mixed isomers)	25551-13-7	0 5-5
24) 1, 2, 4-Trimethylbenzene (Pseudocumene)	95-63-6	0 25-2 5
25) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	0.5-5
26) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	1-5
27) Naphthalene	91-20-3	0.1-0.75
28) C10-C12 Alkylbenzenes	70693-06-0	1-5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact Skin contact. Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of **hydrogen sulfide (H₂S)** are immediately dangerous to life and health (IDLH). At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)

This gas/liquid mixture contains "simple asphyxiants". High concentrations can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.

Breathing high concentrations of the liquid-phase vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes.

Naphtha/Hydrogen Mixed Phase Streams

Eye Contact	Vapors may cause mild to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentration of hydrogen sulfide and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Direct liquid contact can cause clouding of the cornea with small areas of superficial corneal necrosis.
Skin Contact	Direct contact with a liquefied/pressurized gas portion of this material may produce severe and possibly permanent skin damage from frostbite or freeze burns. Tests on this material's components suggest that moderate to severe skin irritation, inflammation, and blistering is expected to occur upon short-term liquid contact. Certain components of this material, including hydrogen sulfide, n-hexane, cyclohexane, benzene, n-heptane, toluene, iso-octane, and xylene isomers may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases.
Ingestion	Ingestion of this material is highly unlikely due to its volatile nature. However, if swallowed this material may irritate the mucous membranes of the mouth, throat, and esophagus. The liquid-phase can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium. Additional central nervous system (CNS) effects may occur prior to the onset of convulsions, coma, and death. Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. Chronic inhalation to components of this material (propane, n-butane, n-pentane, n-heptane, and toluene) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs . Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Prolonged and/or repeated liquid or mist contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis. Also, chronic inhalation of light naphtha vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Even with acute exposures, n-hexane is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, 2,5-hexanedione , has been shown to cause degeneration of the testes. Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents. Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this product may be harmful or fatal. Chronic occupational toluene and xylene exposures have caused auditory nerve degeneration. Available information indicates that toluene is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities. At high exposure concentrations, ethylbenzene has been associated with multiple organ tumors in lab animals.

Naphtha/Hydrogen Mixed Phase Streams

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylenes and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. Also based upon animal testing, the **C9 aromatic hydrocarbon components (trimethylbenzenes and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period.

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic. (See Section 11)

Conditions Aggravated by Exposure Personnel with eye, skin, cardiovascular, pulmonary, blood, liver, kidney, or neurological disorders, impaired hearing, high blood pressure, women attempting to conceive, and chronic respiratory diseases or those with a compromised ability to use oxygen (asthmatics, anemics, etc) should take additional precautions to minimize or avoid exposure

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians")

Target Organs This material is toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, especially the auditory and peripheral nerves, brain, heart, liver, kidneys, thymus, and possibly, the blood, endocrine, and reproductive systems.

Carcinogenic Potential This material contains benzene, ethylbenzene, and naphthalene at concentrations above 0.1%. **Benzene** is considered to be a known human carcinogen by OSHA, IARC and NTP and both **ethylbenzene and naphthalene** are considered possibly carcinogenic to humans by IARC (See Section 11)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Naphtha/Hydrogen Mixed Phase Streams

Notes to Physician

Nitrite as an antidote for acute **hydrogen sulfide** intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients

This material may also make the heart more susceptible to arrhythmias (irregular beats) Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard As a result, induction of emesis is not recommended Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position Obtain chest X-ray and liver function tests Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas, Liquefied Gas, and IA Liquid		
Flash Point Method	CLOSED CUP AP -107° to -73°C (-160° to -100°F) (Estimated)		
Lower Flammable Limit	1.6 to 4.0%	Upper Flammable Limit	7 to 45%
Autoignition Temperature	260° to 288°C (500° to 550°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans		
Special Properties	This gas/liquid mixture is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air If released, immediately evacuate personnel to a safe upwind area It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas/Liquid Mixture! Release causes an immediate fire or explosion hazard Evacuate all non-essential personnel from immediate area to an area far upwind Establish a "regulated zone" with site control and security. Eliminate all ignition sources. If possible, allow this material to evaporate Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak If possible, turn leaking containers so that gas escapes rather than liquid A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing Use water spray to reduce vapors or divert vapor cloud drift A vapor-suppressing foam may also be used to reduce vapors **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid Stop the leak if it can be done without risk Safety stop the source gas flow using non-sparking tools All equipment used when handling this material must be grounded.

Naphtha/Hydrogen Mixed Phase Streams

Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

For large spills, secure the area and control access. If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. Cover spill with a vapor-suppressing foam as soon as possible. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Allow free liquid to evaporate, burn off, or pick it up for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor, it may contain **hydrogen sulfide (H₂S), mercaptans, and/or simple asphyxiants**. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S and mercaptan concentrations, and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored/handled, install monitoring equipment or system with alarms.

Naphtha/Hydrogen Mixed Phase Streams

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection	Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
Hand Protection	Avoid skin contact and use gloves (e.g. disposable neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this gas/liquid mixture may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning: Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Air purifying respirators offer no protection against hydrogen sulfide and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 5 (ppm) from ACGIH (TLV) [Proposed] TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL)
2) Hydrogen	Simple asphyxiant
3) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
4) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
5) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
6) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
7) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 (ppm) from OSHA (PEL) [Proposed]
8) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
9) n-Hexane	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 50 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
10) Cyclohexane	TWA: 100 (ppm) from ACGIH (TLV) TWA: 300 (ppm) from OSHA (PEL)
11) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) - SKIN
12) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
13) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN

Naphtha/Hydrogen Mixed Phase Streams

14) Methylcyclohexane	TWA 100 STEL 150 (ppm) from OSHA (PEL) [Proposed] TWA 200 CEIL: 300 (ppm) from OSHA (PEL) TWA 400 (ppm) from ACGIH (TLV) TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA 500 (ppm) from OSHA (PEL)
15) Octane, all isomers	TWA 300 (ppm) from ACGIH (TLV) TWA 300 STEL 375 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
16) Xylenes (Mixed Isomers)	TWA 100 STEL 150 (ppm) from ACGIH (TLV) TWA: 100 STEL 150 (ppm) from OSHA (PEL) [Proposed] TWA: 100 (ppm) from OSHA (PEL)
17) Ethylbenzene ("A3" Animal Carcinogen)	TWA 100 STEL 125 (ppm) from ACGIH (TLV) TWA 100 STEL 125 (ppm) from OSHA (PEL) [Proposed] TWA 100 (ppm) from OSHA (PEL)
18) Nonane, all isomers	TWA 200 (ppm) from ACGIH (TLV) TWA 200 (ppm) from OSHA (PEL) [Proposed]
19) Trimethylbenzene (mixed isomers)	TWA 25 (ppm) from ACGIH (TLV) TWA: 25 (ppm) from OSHA (PEL) [Proposed]
20) Naphthalene ("A3" = Animal Carcinogen [Proposed])	TWA 10 STEL 15 (ppm) from ACGIH (TLV) - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed] TWA 10 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas, Liquefied Gas, and Liquid Mixture.	Color	Transparent, colorless to slightly yellow liquid, invisible gas and vapor, white frost at release point	Odor	Strong, foul smelling, rotten egg odor is unreliable as a warning of possible exposure.
Specific Gravity	0.60 to 0.75 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to H ₂ SO ₄	Vapor Density	2.0 to 3.5 (Air = 1)
Boiling Point/Range	-89°C to 235°C (-128° to 455°F) [ASTM D-2887]	Melting/Freezing Point	-187° to -46°C (-305° to -50°F) at 14.7 psia.		
Vapor Pressure	10 to 190 psia at 100°F.	Viscosity (cSt @ 40°C)	0.01 to 1.0		
Solubility in Water	Moderately soluble in cold water	Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud. Volatile Organic Compounds (VOC) Content = 100%, 400 to 750 gm/L.		
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard Hydrogen Sulfide and Mercaptans Content = 0.1 to 3 Vol.%, Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 30 to 90 Wt.% [ASTM D-1319]; C6-C12 Aromatic Hydrocarbons Content = 5 to 30 Wt.% [ASTM D-1319]; Olefin Hydrocarbons Content = 5 to 37 Wt.% [ASTM D-1319], Average Density at 60°F = 5.660 lbs/gal. [ASTM D-2500]; 90% Boiling Point Temperature = 415° to 435°F (213° to 224°C) [ASTM D-86]; Dry Point Temperature = 450°F (232°C) [ASTM D-86].				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, calcium hypochlorite, chlorates, permanganates, nitrates, hydrogen peroxide, mercury oxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS		

Naphtha/Hydrogen Mixed Phase Streams

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen sulfide:

- GAS (TC_{Lo}) Acute 10 ppm for 15 minutes (Human) - Eye irritation
- GAS (TC_{Lo}) Acute. 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation.
- GAS (LC₁₀₀) Acute 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death
- GAS (LC_{Lo}) Acute 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (> 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol % in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred, however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. **Butane** is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects, however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic. **n-Hexane** is NOT a tumor promotor in mice and NOT considered to be carcinogenic, nor is it teratogenic in mice or rats. **n-Hexane**, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depression, narcosis, and death at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral routes, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys and brain. Cyclohexane does not act as a promotor for tumors on mice when exposed to **dimethylbenzanthracene**. Further, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation, however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Naphtha/Hydrogen Mixed Phase Streams

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. If ingested, benzene's lethal dose for a normal human adult is one teaspoon to one ounce (~10 mL). Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children/teenagers have less resistance.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by inhalation and dermal exposure and repeated direct skin application can produce defatting dermatitis. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects, however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (< 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Naphtha/Hydrogen Mixed Phase Streams

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic, nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

NTP completed a 2-year inhalation bioassay of **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level, and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. Its TC_{10} for humans 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation studies with rats, four of ten animals died after exposures of 2,400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. **Mesitylene (1,3,5-Trimethylbenzene)** inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Naphtha/Hydrogen Mixed Phase Streams

Ethylmethylbenzenes are primary skin irritants. Overexposure has been associated with kidney damage and increased blood cholinesterase levels. In inhalation developmental studies, these and other **C9 aromatic hydrocarbons** have been associated with decreased fetal and newborn pup weights.

Naphthalene is a potential irritant to eyes, skin and lungs. Ingestion of naphthalene has been associated with severe red blood cell and liver damage leading to death. Following prolonged or repeated exposures, naphthalene has been shown to cause cataracts, optical neuritis, hemolytic and aplastic anemia, kidney damage (jaundice), and possibly neurotoxicity. In animal studies, naphthalene caused fetal effects and decreased spleen weights in pregnant female mice. In an NTP sponsored study, naphthalene produced a dose related increase in tumors at the 30 and 60 ppm exposure level in both male and female rats. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas and non-neoplastic lesions of the nose were observed as compared to controls. Cytogenic studies with Chinese hamster ovary cells have demonstrated sister chromatid exchanges and chromosomal aberrations. The relevance of these studies to human health is unclear.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage, however, at ambient temperatures and pressure, the **butenes, hydrogen sulfide, and the mercaptan** components of this material may contribute to generation of atmospheric smog. If released, the volatile **aromatic hydrocarbon components (benzene and toluene)** may also contribute to the creation of atmospheric smog. The atmospheric half-lives of **propane and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours; and, experimental data shows that significant photooxidation of propylene occurs rapidly within 14 to 21 hours. The atmospheric half-lives of **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **propane, isobutane, and n-butane** in air (< 8%) are not considered environmentally significant.

Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time. The **pentanes, n-hexane, and hexane isomers** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. **Toluene** has a half-life of from 3 hours to slightly over 1 day and both **cyclopentane and cyclohexane** have a half-lives of from 6 hours to over 4 days when hydroxyl radicals are present.

If spilled, the liquid portion of this material, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels. Also, the toxic **hydrogen sulfide and the mercaptans** are moderately soluble in water. Volatile **aromatic hydrocarbon components (benzene, toluene, xylenes, ethylbenzene, trimethylbenzene, and naphthalene)** may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 20 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 60 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), Guppy (*Lebistes reticulatus*) and juvenile American Shad (*Squalius cephalus*) in fresh water. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

The naphtha portion of this mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

Naphtha/Hydrogen Mixed Phase Streams

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas/liquid to the atmosphere should be avoided. Maximize material recovery for reuse or recycling.

If spilled and the naphtha portion of this mixture is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase and vapor emissions from the process might prove to be a potential health hazard. The naphtha portion of this mixture is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitability (D001) and/or toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U S Department of Transportation regulated material		
Proper Shipping Name	Compressed gases, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen, Hydrogen sulfide)		
Hazard Class	DOT Class: 2.3 (Poisonous gas) and 2.1 (Flammable gas).	Packing Group(s) UN/NA ID	Not applicable UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Benzene and Xylenes .		
Placards	Emergency Response Guide No. 119		
			HAZMAT STCC No. 49 203 78
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance present in this material that is subject to this statute is Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.1 to 1%.

Naphtha/Hydrogen Mixed Phase Streams

SARA 311/312	<p>The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:</p> <p>Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.</p>
SARA 313	<p>This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313:</p> <p>Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.1 to 1% n-Hexane [CAS No. 110-54-3] concentration: 0.5 to 5% Cyclohexane [CAS No. 110-82-7] concentration: 0.5 to 3% Benzene [CAS No. 71-43-2] concentration: 0.1 to 3% Toluene [CAS No. 108-88-3] concentration: 1 to 5% Xylenes [CAS No. 1330-20-7] concentration: 1 to 10% Ethylbenzene [CAS No. 100-41-4] concentration: 0.2 to 2.5% 1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 95-63-6] concentration: 0.25 to 2.5% Naphthalene [CAS No. 91-20-3] concentration: 0.1 to 0.75%.</p>
CERCLA	<p>The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which are present in this material that are subject to this statute are:</p> <p>Hydrogen sulfide [CAS No. = 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 1% n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 0.5 to 5% Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.5 to 3% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 3% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-1] (RQ = 1000 lbs. [453.6 kg]) conc.: 0 to 2% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 10% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.2 to 2.5% Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0.05 to 0.5% Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 0.75%.</p>
CWA	<p>This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.</p>
California Proposition 65	<p>This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2], Toluene [CAS No. 108-88-3], and Naphthalene [CAS No. 91-20-3].</p>
New Jersey Right-to-Know Label	<p>For New Jersey labeling, refer to the components listed in Section 2.</p>
Additional Regulatory Remarks	<p>Under Section 12(b) of the Toxic Substances Control Act: Because it contains detectable amounts of Cyclohexane (CAS No. 110-82-7), this material might be subject to US EPA's one-time only per country export notification requirements.</p> <p>In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": Isopentane [CAS No. 78-78-4], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 106-98-9], Methylcyclohexane [CAS No. 108-87-2], and Toluene [CAS No. 108-88-3], Xylenes [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], and Cumene (Isopropylbenzene) [98-82-8].</p> <p>In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in this material which are subject to this statute include: Hydrogen sulfide, Hydrogen, Propane, Isobutane (Propane, 2-methyl), n-Butane, Isopentane (Butane, 2-methyl), 2,2-Dimethylpropane (Neopentane), and n-Pentane.</p>

Naphtha/Hydrogen Mixed Phase Streams**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2 0
Revision Date 09/12/2002
Print Date Printed on 09/12/2002

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0120
Revision Date 04/16/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquefied Gas/ Liquid Mixture.		
Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure.

DANGER! Extremely flammable and poisonous gas/liquid;
vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
High concentrations of vapor reduce oxygen available for breathing!
Contains Hydrogen Sulfide (H₂S)! Corrosive to some metals!
**May be harmful or fatal if inhaled, ingested, or absorbed through
the skin!**
May cause central nervous system (CNS) depression or suffocation!
Liquid or compressed gas contact may cause frostbite or freeze burns!
**Mist or vapor may cause mild to severe eye, skin, mucous membranes,
and respiratory tract irritation and inflammation!**
**Aspiration into the lungs will cause pulmonary edema and
chemical pneumonia!**
**Overexposures may cause central nervous system (CNS)
depression and target organ effects such as lung, brain,
peripheral nerves, blood and blood-forming tissue,
cardiopulmonary, liver, and/or kidney damage!**
**Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats)!**
Cancer hazard! Contains low levels of Benzene and 1,3-Butadiene!
May cause leukemia and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
May adversely affect reproduction or reproductive development!
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

COR

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Sour Naphtha/Hydrogen Mixed Phase Refinery Streams	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111111154	Medical Emergency	(918) 495-4700
CAS Number	Mixture	CHEMTREC Emergency	(800) 424-9300
Product Family	Gas/Liquid Phase Mixture of Hydrogen, Sour Reformate Gas, and Naphtha		
Synonyms	Hydrodesulfurization Reactor Naphtha; Reformer Reactor Feed and Recirculation; Magnaformer RX Mixed Feedstock and Circulation, Refinery Overhead Collection System Drips, Reformer Gas/Hydrogen Recycle/Light Naphtha Mixture.		

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrogen	1333-74-0	40-90
2) Carbon dioxide	124-38-9	0-15
3) Nitrogen	7727-37-9	0-12
4) Hydrogen sulfide	7783-06-4	0-2.2
5) Methane	74-82-8	0-12
6) Ethane	74-84-0	0-7
7) Ethylene	74-85-1	0-5
8) Propane	74-98-6	0-5
9) Propylene	115-07-1	0-2
10) Butanes	Mixture	0-3
11) 1,3-Butadiene	106-99-0	0-0.4
12) Butenes or Butylenes	25167-67-3	0-2
13) Pentanes	Mixture	0-5
14) Hexane Isomers	Mixture	6-9
15) n-Hexane	110-54-3	1-7
16) Cyclohexane	110-82-7	0-2
17) Benzene	71-43-2	0.1-1.0
18) Methylcyclohexane	108-87-2	1-3
19) Toluene	108-88-3	0.8-2
20) Xylene, Mixed Isomers	1330-20-7	1-3
21) Ethylbenzene	100-41-4	0.3-0.7
22) Trimethylbenzenes	25551-13-7	0-2

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact Skin absorption

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of **hydrogen sulfide (H₂S)** are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11)

Additionally, several components of this gas/liquid mixture are "simple asphyxiants". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.

Breathing high concentrations of the liquid-phase vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes.

Eye Contact

Vapors may cause mild to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of **hydrogen sulfide** and duration of exposure. Direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Direct liquid contact can cause clouding of the cornea with small areas of superficial corneal necrosis

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

Skin Contact	Direct contact with an expanding gas may produce severe and possibly permanent skin damage from frostbite or freeze burns. Hydrogen sulfide can be absorbed through the skin to produce toxic effects. Tests on this stream's components suggest that mild to severe skin irritation, inflammation, and blistering is expected to occur upon short-term liquid contact. Certain components of this material, including n-hexane, benzene, toluene, xylenes, and ethylbenzene may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases
Ingestion	Ingestion of this material is highly unlikely due to its volatile nature. However, if swallowed this material may irritate the mucous membranes of the mouth, throat, and esophagus. The liquid-phase can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium. Additional central nervous system (CNS) effects may occur prior to the onset of convulsions, coma, and death. Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.) Chronic inhalation to components of this mixed stream (carbon dioxide, propane, n-butane, n-pentane, and toluene) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs . Prolonged and/or repeated liquid or mist contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis. Also, chronic inhalation of light naphtha vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Even with acute exposures, n-hexane is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis of the feet and/or hands. Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents. Available information indicates that toluene is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities. 1,3-Butadiene (BD) , a minor component of this stream, has been shown to be mutagenic and produces multiple organ tumors in various tissues of laboratory rodents. BD also causes sexual organ atrophy in test animals.
Conditions Aggravated by Exposure	Personnel with eye, skin, cardiovascular, pulmonary, blood, liver, kidney, or neurological disorders, impaired hearing, high blood pressure, and chronic respiratory diseases or those with a compromised ability to use oxygen (asthmatics, anemics, etc.) should take additional precautions to minimize or avoid exposure.
Target Organs	The substance is toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, especially the auditory and peripheral nerves, brain, heart, liver, kidneys, thymus, and possibly, the endocrine and reproductive systems.
Carcinogenic Potential	This refinery stream contains benzene and possibly 1,3-butadiene at concentrations above 0.1%. These substances are considered carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

**Sour Naphtha/Hydrogen
Mixed Phase Refinery Streams**

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).									
OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.</p> <p>Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.</p> <p>If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p>

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas, Liquefied Gas, and IA Liquid		
Flash Point/Method	CLOSED CUP AP -107° to -73°C (-160° to -100°F) (Estimated)		
Lower Flammable Limit	AP 1.6 to 4.0%	Upper Flammable Limit	AP 45 to 75%
Auto-Ignition Temp.	AP 260°C (500°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.		
Special Properties	This gas/liquid mixture is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas/Liquid Mixture! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. Cover spill with a vapor-suppressing foam as soon as possible. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Some releases/spills may need to be reported to the National Response Center (800/424-8802)

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it may contain **hydrogen sulfide (H₂S)**. This gas mixture also contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.

Hand Protection

Avoid skin contact and use gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this gas/liquid mixture may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, and simple asphyxiants.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL 15 (ppm) from ACGIH (TLV) [1998] TWA: 10 STEL 15 CEIL: 20 (ppm) from OSHA (PEL) [1989]
2) Hydrogen	Simple asphyxiant.
3) Carbon dioxide	TWA: 5000 STEL: 30000 (ppm) from ACGIH (TLV) [1998] TWA: 5000 STEL: 30000 (ppm) from OSHA (PEL) [1989]
4) Nitrogen	Simple asphyxiant.
5) Methane	Simple asphyxiant
6) Ethane	Simple asphyxiant
7) Ethylene	Simple asphyxiant.
8) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
9) Propane	TWA: 2500 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1989]
10) Propylene	Simple asphyxiant.
11) Butanes	TWA: 800 (ppm) from ACGIH (TLV) [1998] TWA: 800 (ppm) from OSHA (PEL) [1989]
12) 1,3-Butadiene ("A2" and "Z-2" Carcinogen)	TWA: 2 (ppm) from ACGIH (TLV) [1998] TWA: 2 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) [1994]
13) Pentanes	TWA: 600 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1976]
14) n-Hexane	TWA: 50 (ppm) from ACGIH (TLV) [1998] SKIN TWA: 500 (ppm) from OSHA (PEL) [1976]
15) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1989]
16) Cyclohexane	TWA: 300 (ppm) from ACGIH (TLV) [1998] TWA: 200 STEL: 400 (ppm) from ACGIH (TLV) [1999] TWA: 300 (ppm) from OSHA [1976]
17) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1998] - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
18) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1976]
19) Toluene	TWA: 50 (ppm) from ACGIH (TLV) [1998] SKIN TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
20) Xylenes	TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989] TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1998]
21) Ethylbenzene	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [1998] TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [1989]
22) Trimethylbenzenes	TWA: 25 (ppm) from ACGIH (TLV) [1998] TWA: 25 (ppm) from OSHA (PEL) [1989]

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas/ Liquid Mixture.	Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg odor is unreliable as a warning of possible exposure
Specific Gravity	AP 0.60 to 0.65 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to acidic H ₂ SO ₄ .	Vapor Density	AP 1.5 (Air = 1)
Boiling Point/Range	AP -253°C to 176°C (-423° to 350°F) (by ASTM D-2887)		Melting/Freezing Point		AP -187° to 12°C (-305° to 55°F) at 14.7 psia
Vapor Pressure	50 to 190 psia at 100°F.		Viscosity (cSt @ 40°C)		Not applicable
Solubility in Water	Moderately soluble in cold water		Volatile Characteristics		This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.
Additional Properties	This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard. Hydrogen, Hydrogen Sulfide, Carbon Dioxide, and Nitrogen Content = 40 to 90 Vol.%; Alkane, Isoparaffin, Alkene, and Cycloalkane Hydrocarbons Content = 8 to 51 Wt.% (ASTM D-1319); C6-C9 Aromatic Hydrocarbon Content = 2 to 9 Wt.% (ASTM D-1319); Average Density at 60°F = 5.21 lbs /gal. (ASTM D-2161).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Hydrogen sulfide: GAS (TCLo): Acute: 10 ppm for 15 minutes (Human) - Eye irritation. GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation GAS (LC100): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death. GAS (LCLo): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.</p> <p>Carbon dioxide: GAS (LC50): Acute: 80,000 ppm for 15 minutes (Human) - Tremors, loss of consciousness, and death.</p> <p>Propylene. GAS (LC50): Chronic: 1,250 ppm for 6 hours/day for 14 weeks [Mouse]. GAS (TCLo): Chronic: 5,000 ppm for 6 hours/day for 2 years [Rat] - Reduced olfactory sensory response.</p> <p>Iso-Butane: GAS (TCLo): Acute: 1,040 gm/m³ for 2 hours [Mouse] - Excitement. GAS (LC50): Acute: 57,000 ppm for 15 minutes [Rat] - Tremors, convulsions, and respiratory distress.</p> <p>Iso-Butene (Isobutylene or 2-Methylpropene): GAS (LC50): Acute: 415 gm/m³ for 2 hours [Mouse]. GAS (LC50): Acute: 620 gm/m³ for 4 hours [Rat].</p> <p>n-Butane: GAS (LC50): Acute: 660 gm/m³ for 4 hour(s) [Rat]. GAS (LC50): Acute: 680 gm/m³ for 2 hours [Mouse].</p> <p>1,3-Butadiene: GAS (LC50) Acute: 285 gm/m³ for 4 hour(s) [Rat] GAS (LC50): Acute: 270 gm/m³ for 2 hours [Mouse]. ORAL (LD50): Acute: 5,480 mg/kg [Rat].</p>
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Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

2,2-Dimethylpropane (Neopentane)

INTRAPERITONEAL (LD50) Acute: 100 mg/kg [Mouse].

n-Pentane:

GAS (LC50). Acute. 364 gm/m³ for 4 hour(s) [Rat] - Excitement.

INTRAVENOUS (LD50): Acute: 446 mg/kg [Mouse].

n-Hexane:

GAS (LC50): Acute: 48,000 ppm for 4 hours [Rat].

ORAL (LD50): Acute: 28,710 mg/kg [Rat].

Cyclohexane

GAS (LC50): Acute 22,500 ppm for 4 hours [Rabbit].

ORAL (LD50): Acute. 12,705 mg/kg [Rat]

ORAL (LD50): Acute: 813 to 1,300 mg/kg [Mouse]

ORAL (LD50): Acute: GT 180,000 mg/kg [Rabbit].- Severe diarrhea, vascular damage and collapse, hepatocellular degeneration, and glomerulonephritis.

Benzene:

ORAL (LD50). Acute. 930 mg/kg [Rat] - Tremors and convulsions

ORAL (LD50): Acute: 4,700 mg/kg [Mouse].

ORAL (LD50): Acute: 5,700 mg/kg [Unidentified mammal].

GAS (LC50): Acute: 10,000 ppm for 7 hours [Rat].

GAS (LC50): Acute: 9,980 ppm for 8 hours [Mouse] - General anesthesia, muscle weakness, and dyspnea

DERMAL (LD50): Acute: 48 mg/kg [Mouse].

DERMAL (LD50) Acute. GT 9,400 uL/kg [Rabbit and Guinea Pig].

INTRAPERITONEAL (LD50): Acute: 340 mg/kg [Mouse].

INTRAPERITONEAL (LD50): Acute: 2,890 ug/kg [Rat] - Lung and liver damage plus decreased blood cells.

Methylcyclohexane:

ORAL (LD50): Acute: 2,250 mg/kg [Mouse].

GAS (LC50): Acute: 41,500 mg/m³ for 2 hours [Mouse] - Hypermotility and diarrhea

GAS (LC50): Acute: 15,227 ppm for 1 hour [Rabbit] - General anesthetic, convulsions, and changes in the salivary glands.

Toluene:

ORAL (LD50): Acute: 636 mg/kg or [Rat].

ORAL (LD50): Acute: 4,000 mg/kg or [Cat].

GAS (LC50): Acute: 49,000 mg/m³ for 4 hours [Rat].

GAS (LC50): Acute: 5,320 ppm for 8 hours [Mouse]

GAS (LC50): Acute: 400 ppm for 24 hours [Mouse].

DERMAL (LD50): Acute: 14,100 uL/kg or 12,125 mg/kg [Rabbit].

INTRAVENOUS (LD50): Acute: 1,960 mg/kg [Rat].

INTRAVENOUS (LD50). Acute: 2,000 mg/kg [Mouse].

SUBCUTANEOUS (LD50): Acute: 2,250 mg/kg [Mouse].

INTRAPERITONEAL (LD50): Acute: 59 mg/kg [Mouse].

INTRAPERITONEAL (LD50). Acute. 500 mg/kg [Guinea Pig].

INTRAPERITONEAL (LD50): Acute: 1,332 mg/kg [Rat].

Xylenes:

ORAL (LD50): Acute 4,300 mg/kg [Rat].

GAS (LC50): Acute 4,550 ppm for 4 hours [Rat].

DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit].

SUBCUTANEOUS (LD50): Acute: 1,700 mg/kg [Rat].

INTRAPERITONEAL (LD50): Acute: 2,459 mg/kg [Rat]

INTRAPERITONEAL (LD50): Acute: 1,548 mg/kg [Mouse].

Ethylbenzene:

ORAL (LD50): Acute: 3,500 mg/kg [Rat].

DERMAL (LD50): Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50): Acute: 2,624 mg/kg [Rat].

Trimethylbenzenes:

ORAL (LD50): Acute: 8,970 mg/kg [Rat].

1,2,4-Trimethylbenzene:

ORAL (LD50): Acute: 5,000 mg/kg [Rat]

GAS (LC50): Acute: 18,000 mg/m³ for 4 hours [Rat].

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

Hydrogen sulfide (H₂S): H₂S causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Many people have died from overexposure to **carbon dioxide (CO₂) gas**. CO₂ exerts direct toxicity on the heart, resulting in diminished contractile force. It is also a vasodilator, and is the most potent cerebrovascular dilator known. At an airborne concentration of 5,500 ppm for 6 hours, CO₂ has no ill effects, while at 3% (30,000 ppm) it is mildly narcotic and causes reduced hearing, increased blood pressure, and rapid pulse. Concentrations of 50,000 to 80,000 ppm (5 to 8%) produce normal symptoms of hypoxia (see Section 3) within 10 minutes. And, at 8 to 10% in air, CO₂ causes tremors, hypertension, difficulty in breathing, and loss of consciousness within 5 to 10 minutes. Extended exposure to concentrations between 10 and 15% can be lethal. Breathing 20% CO₂ in air for 1 minute causes convulsions, unconsciousness, and usually death.

Long-term exposure to airborne **carbon dioxide** concentrations as low as 0.5 to 1%, while being generally well tolerated, can alter the body's acid-base and calcium-phosphorus balance, resulting in metabolic acidosis and increased calcium deposits in soft tissues. Chronic exposure to levels of 1 to 2% CO₂ in air can stress the adrenal cortex because of constant respiratory stimulation; if not given a period of gradual adaption, this level of exposure is considered dangerous after several hours. CO₂ might also be a threat to the well-being of the unborn if a pregnant woman is exposed enough to cause metabolic acidosis. This decreases the blood supply to the uterus which increases fetal breathing movements and reduces fetal development. Also, laboratory rat studies suggest that CO₂ exposures may adversely affect male reproduction by altering the testes causing premature release of sperm and reduced fertility.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced **NO ABNORMAL REACTIONS** in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

In humans, at concentrations of 6.4% in air or higher, **propylene** causes mild intoxication, dermal sensations, and an inability to concentrate on tasks within two minutes. Gross inhalation of propylene concentrations of 40% or higher for a couple minutes cause reddening of the eyelids and face, tearing, coughing, and sometimes flexing of the legs, reduced blood pressure, and/or disordered heart rhythm. A concentration of 50% causes anesthesia in two minutes, followed by complete recovery without any physiological indications.

Chronic low-level exposures to **ethylene and/or propylene** may entail a possible hazard from the formation of their reactive metabolites, **ethylene oxide and/or propylene oxide**, which are "suspect human carcinogens". However, **ethylene and propylene** have not been shown to be carcinogenic in rat studies. For example, **Propylene** was tested by the National Cancer Institute (NCI) in a two-year, 6 hours/day, 5 days/week inhalation study using rats and mice with exposure concentrations at 5,000 and 10,000 ppm. The resulting data suggested that propylene induces signs of nasal cavity toxicity (epithelial hyperplasia/metaplasia) including increased incidence of neo-plastic lesions in rats, but not in mice. Propylene is NOT considered carcinogenic to either rats or mice even though it may be partially metabolized to **propylene oxide** which has been shown to be mutagenic and produces site of contact tumors in rodents following long-term administration. Propylene has also been found to be a cardiac sensitizer in dogs.

Human volunteers had no apparent effects from exposures of 250 ppm, 500 ppm, and 1,000 ppm concentrations in air of **isobutane and n-butane** for periods of 8 hours daily for 10 days to 14 days, respectively. Chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage.

An **n-Butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane, butylene, and/or 1,3-butadiene** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

At very high concentrations, **1,3-butadiene (BD)** produces narcosis with central nervous system depression and/or respiratory paralysis. Lifetime inhalation studies have shown BD or its epoxide metabolites cause multiple organ tumors in various tissues of both rats and mice. It is also a mutagen and causes sexual organ atrophy in test animals. Epidemiology studies amongst BD workers and styrene-butadiene rubber (SBR) workers suggest that BD or BD epoxide metabolite exposures may increase the risk of cancers of the lymphohematopoietic system. Based on these various studies, IARC, NTP, OSHA, ACGIH, and EPA have determined BD to be an "animal carcinogen" and a "probable human carcinogen".

Intentional sniffing abuse of **n-hexane** has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to n-hexane, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (polyneuropathy). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane may be increased by concurrent exposure to **methyl ethyl ketone, methyl isobutyl ketone, and/or toluene**

n-Hexane is NOT a tumor promotor in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. n-Hexane, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.

Cyclohexane is an eye, skin, and mucous membrane irritant, CNS depressant, and causes narcosis at high concentrations in air. There is a narrow margin between narcosis, loss of reflexes, and death. In experimental animals exposed to lethal concentrations by inhalation or oral route, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys, and brain. Cyclohexane does not act as a promotor for tumors on mice when exposed to dimethylbenzanthracene; and, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation, however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Benzene has an IDLH (immediately dangerous to life or health) concentration = 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes.

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children and teenagers have a lower resistance to bone marrow poisons.

Studies with pregnant laboratory animals have demonstrated that **benzene** is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may all cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **ethylbenzene** and the **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay on **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. NTP, IARC, and OSHA have not designated ethylbenzene as a carcinogen.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **propylene**, **butenes**, and **hydrogen sulfide** components of this material may contribute to generation of atmospheric smog. If released, the volatile **aromatic hydrocarbon components (toluene, xylenes, and ethylbenzene)** may also contribute to the creation of atmospheric smog. The atmospheric half-lives of **propane**, **propylene**, and **butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours; and, experimental data shows that significant photooxidation of propylene occurs rapidly within 14 to 21 hours. The atmospheric half-lives of **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **propane**, **isobutane**, and **n-butane** in air (LT 8%) are not considered to be environmentally significant.

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time. The **pentanes, n-hexane, and hexane isomers** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. **Toluene** has a half-life of from 3 hours to slightly over 1 day and **Cyclohexane** has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present.

If spilled, the naphtha portion of this stream, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Also, toxic **hydrogen sulfide** is moderately soluble in water.

Environmental Fate

The naphtha portion of this mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas/liquid to the atmosphere should be avoided. Maximize material recovery for reuse or recycling.

If spilled and the naphtha portion of this mixture is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase and vapor emissions from the process might prove to be a potential health hazard. The naphtha portion of this mixture is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Liquefied gas, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide)		
Hazard Class	Class 2.3: Poisonous gas.	Packing Group(s)	Not applicable.
		UN/NA ID	UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Benzene, Xylenes, and/or Hydrogen sulfide.		

**Sour Naphtha/Hydrogen
Mixed Phase Refinery Streams**

Emergency Response Guide No. 119

Placards



HAZMAT STCC No.

49 057 66

MARPOL III Status

Not a DOT "Marine Pollutant"
per 49 CFR 171.8.**SECTION 15: REGULATORY INFORMATION**

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A chemical substance present in this product or refinery stream subject to this statute is Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0 to 2.2%.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Reactivity, and Acute (Immediate) & Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0 to 2.2% Ethylene or Ethene [CAS No. = 74-85-1] concentration: 0 to 2% Propylene or Propene [CAS No. = 115-07-1] concentration: 0 to 2% 1,3-Butadiene [CAS No. = 106-99-0] concentration: 0 to 0.4% n-Hexane [CAS No. 110-54-3] concentration: 1 to 7% Cyclohexane [CAS No. 110-82-7] concentration: 0 to 2% Benzene [CAS No. 71-43-2] concentration: 0.1 to 1% Toluene [CAS No. 108-88-3] concentration: 0.8 to 2% Xylenes [CAS No. 1330-20-7] concentration: 1 to 3%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this stream which are subject to this statute are: Hydrogen sulfide [CAS No. = 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 2.2% n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 1 to 7% Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 2% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 1% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.8 to 2% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 3% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.3 to 0.7%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, they may be subject to requirements of California Health & Safety Code Section 25249.5: 1,3-Butadiene [CAS No. = 106-99-0], Benzene [CAS No. 71-43-2], and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.

Sour Naphtha/Hydrogen Mixed Phase Refinery Streams

Additional Regulatory Remarks

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": **Ethylene (Ethene), Propylene (Propene), 1,3-Butadiene, 1-Butene, n-Pentane, Cyclohexane, Benzene, Methylcyclohexane, Toluene, and Xylenes.**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this product which are subject to this statute are: **Hydrogen, Methane, Ethane, Ethylene, Propane, Propylene (1-Propene), Isobutane (Propane, 2-methyl), various Butenes, Butane, 1,3-Butadiene, Isopentane (Butane, 2-methyl), n-Pentane, 2,2-Dimethylpropane (Neopentane), and Hydrogen Sulfide**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2 1
Revision Date 04/16/1999
Print Date Printed on 06/04/1999

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists			AIHA = American Industrial Hygiene Association			
IARC = International Agency for Research on Cancer			NTP = National Toxicology Program			
NIOSH = National Institute of Occupational Safety and Health			OSHA = Occupational Safety and Health Administration			
NPCA = National Paint and Coating Manufacturers Association			HMIS = Hazardous Materials Information System			
NFPA = National Fire Protection Association			EPA = Environmental Protection Agency			

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0122
Revision Date 10/19/2001

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid		
Color	Transparent, colorless to slightly yellow	Odor	Light hydrocarbon to sweet aromatic hydrocarbon Odor threshold is 1 to 7 ppm in air

DANGER! Extremely flammable liquid; vapor may cause flash fire or explosion!
High vapor concentrations reduce oxygen available for breathing!
Mist or vapor may irritate the eyes, nose, and respiratory tract!
Liquid contact may cause mild to moderate eye irritation and/or moderate to severe skin irritation!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss and/or liver, kidney, or peripheral nervous system damage!
May be harmful or fatal if ingested! Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Based upon animal testing, vaporized Gasoline (a similar material) causes tumors! Potential cancer hazard!
Contains low levels of Benzene and Ethylbenzene!
May cause anemia, leukemia, and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
Based upon animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

Hazard Rankings

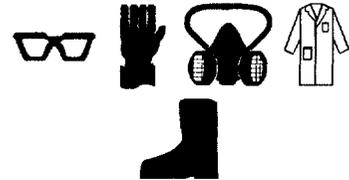
	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements See Section 8 for Details

The personal protective equipment depicted below is recommended for use only at this facility



SECTION 1: IDENTIFICATION

Trade Name	Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068955351*	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	68955-35-1	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	C4-C12 Petroleum Hydrocarbons		
Synonyms	Reformate, Full-range Reformate, Reformate Naphtha or Gasoline; 733 Reformer Product, HDS Unit Feed, Platformate, Catalytic Reformed Naphtha (Petroleum), C4-C12 Catalytic Reformed Naphtha or Gasoline		

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Catalytic Reformed Naphtha (Petroleum)	68955-35-1	100
2) Butanes	Mixture	1-3
3) Butenes or Butylenes	25167-67-3	0.5-2
4) Pentanes	Mixture	1-10
5) Pentenes or Pentylenes	68527-11-7	1-3
6) Cyclopentane	287-92-3	1-3
7) Hexane Isomers	Mixture	10-30
8) Hexene Isomers	Mixture	1-3
9) Methylcyclopentane	96-37-7	1-3
10) n-Hexane	110-54-3	10-25
11) Cyclohexane	110-82-7	5-15
12) Benzene	71-43-2	0.1-1
13) Heptanes	Mixture	10-30
14) Methylcyclohexane	108-87-2	1-3
15) C7-C12 alpha-Alkenes	68855-57-2	1-10
16) Toluene	108-88-3	1-4
17) Octanes	Mixture	5-15
18) Xylenes (Mixed Isomers)	1330-20-7	1-5
19) Ethylbenzene	100-41-4	0.2-1
20) Nonanes	Mixture	1-10
21) Cumene	98-82-8	0-2
22) n-Propylbenzene	103-65-1	0.5-1.5
23) Trimethylbenzene (mixed isomers)	25551-13-7	1-3
24) 1,2,4-Trimethylbenzene (Pseudocumene)	95-63-6	0.5-1.5
25) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-3
26) Indene	95-13-6	0.5-1.5
27) Naphthalene	91-20-3	0.1-2
28) C10-C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	1-10
29) C10-C12 Alkylbenzenes	70693-06-0	0-2

SECTION 3: HAZARDS IDENTIFICATION

Also see *Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.*

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of this mixture's vapor may cause upper respiratory tract irritation, headache, nausea, vomiting, and/or central nervous system (CNS) depression. Components of this mixture may also produce mild narcotic effects. Symptoms may include euphoria, excitation or giddiness, abdominal pain, loss of appetite, fatigue, muscular weakness, and staggering gait. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. High vapor concentrations can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 to 10,000 ppm for only 5 minutes.
Eye Contact	Actual human exposures indicate that this product can cause mild to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling. Liquid contact may cause conjunctivitis, small areas of superficial corneal necrosis, and/or permanent clouding of the cornea.
Skin Contact	Actual human exposures indicate that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning or blistering of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

Ingestion	<p>Due to its volatile nature, ingestion is not normally an applicable route of exposure. However, if swallowed, this material may cause a "freeze burn" or irritation with a burning sensation of the mucous membranes in the mouth, throat, and esophagus. The liquid portion can be readily absorbed by the stomach and intestinal tract. Symptoms include nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).</p> <p>Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.</p>
Chronic Health Effects Summary	<p>Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for gasoline abusers. Intentional misuse by deliberately concentrating and inhaling this material may be harmful or fatal.</p> <p>Even with acute exposures, n-hexane is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, 2,5-hexanedione, has been shown to cause degeneration of the testes.</p> <p>Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.</p> <p>Available information indicates that toluene is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.</p> <p>Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational toluene and xylene exposures have caused auditory nerve degeneration.</p> <p>At high exposure concentrations, ethylbenzene has been associated with multiple organ tumors in laboratory animals.</p> <p>Based upon animal testing, the C8 aromatic hydrocarbon components (xylene isomers and ethylbenzene) might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. And, the C9 aromatic hydrocarbons (cumene, n-propylbenzene, trimethylbenzenes, indene, and ethylmethylbenzenes) are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period.</p> <p>Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic. (See Section 11.)</p>
Conditions Aggravated by Exposure	<p>Personnel with pre-existing nervous system disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material. They should take additional precautions to minimize or avoid exposure.</p> <p>Exposure to high concentrations of this material may increase the sensitivity of the heart to epinephrine (adrenalin) and catecholamine-like drugs. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").</p>
Target Organs	<p>The substance is toxic to lungs, nervous system, especially the auditory and peripheral nerves, brain, liver, kidneys, blood and blood-forming tissues, mucous membranes, skin, eyes, and possibly, the heart, thymus, lymph nodes, and reproductive systems.</p>
Carcinogenic Potential	<p>This material contains benzene and ethylbenzene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP and Ethylbenzene are considered possibly carcinogenic to humans by IARC. (See Section 11.)</p>

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)									
OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p> <p>Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable!
Flash Point Method	CLOSED CUP -48° to -37°C (-55° to -35°F) (Tagliabue [ASTM D-56])
Lower Flammable Limit	0.9% in Air. Upper Flammable Limit 8.5% in Air.
Autoignition Temperature	225° to 275°C (435° to 527°F) by ASTM E-659
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

Special Properties

Extremely Flammable Liquid¹ This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Mists or sprays may be flammable at temperatures below the flash point. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard if released into confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.

A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing middle distillates or other higher flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.

Extinguishing Media

SMALL FIRE Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). **LARGE FIRE** Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.

Protection of Fire Fighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquid¹ Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all potential ignition sources because a liquid spill will vaporize rapidly. A vapor-suppressing foam may be used to reduce vapors. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material even when wearing proper respiratory equipment and fire-resistant protective clothing. Do not direct water at the source of leak, but, use water spray to reduce vapors or divert vapor cloud drift. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Spills will most likely need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below), then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

The personal protective equipment depicted below is recommended for use only at this facility.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent). During transfer operations or when this material is being released under pressure, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with vapors and liquid. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use this material as a skin cleaner.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments Releases of this product may create flammable, explosive, and/or oxygen-deficient atmospheres (<19.5 Vol % in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. If the Lower Explosive Limit (LEL) for this product is exceeded, all entry into the contaminated area/confined space should be prohibited. Odor is an inadequate warning for hazardous conditions.

Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Gasoline ("A3" Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) TWA: 300 STEL: 500 (ppm) from OSHA (PEL)
2) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
3) Butane	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
4) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
5) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 (ppm) from OSHA (PEL) [Proposed]
6) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
7) 1-Hexene	TWA: 30 (ppm) from ACGIH (TLV) TWA: 50 (ppm) from ACGIH (TLV) [Proposed]
8) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 50 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
9) Cyclohexane	TWA: 300 (ppm) from ACGIH (TLV) TWA: 100 (ppm) from ACGIH (TLV) [Proposed] TWA: 300 (ppm) from OSHA (PEL)
10) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
11) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
12) Benzene ("A1" and "Z-2" Known Human Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) - SKIN
13) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL)
14) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
15) Xylene, Mixed Isomers	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed]
16) Ethylbenzene ("A3" Animal Carcinogen [Proposed])	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [Proposed]
17) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) TWA: 200 (ppm) from OSHA (PEL) [Proposed]
18) Cumene	TWA: 50 (ppm) from ACGIH (TLV) TWA: 50 (ppm) from OSHA (PEL) - SKIN [Proposed]
19) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) TWA: 25 (ppm) from OSHA (PEL) [Proposed]
20) Indene	TWA: 10 (ppm) from ACGIH (TLV) TWA: 10 (ppm) from OSHA (PEL) [Proposed]
21) Naphthalene	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed] TWA: 10 (ppm) from OSHA (PEL)

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Transparent, colorless to slightly yellow	Odor	Light hydrocarbon to sweet aromatic hydrocarbon. Odor threshold is 1 to 7 ppm in air
Specific Gravity	0.67 to 0.73 (Water = 1)	pH	Not applicable	Vapor Density	2.7 to 3.1 (Air = 1)
Boiling Point/Range	28° to 225°C (82° to 437°F) [ASTM D-86]			Melting/Freezing Point	<-75°C (<-103°F) [ASTM D-97]
Vapor Pressure	15 to 25 mm Hg at 20°C (68°F) or 10 to 16 Reid-psia at 37.8°C (100°F)			Viscosity (cSt @ 40°C)	0.5 to 1.5 [ASTM D-445]
Solubility in Water	Slightly soluble in cold water (<0.2%)			Volatile Characteristics	Volatile Organic Compounds (VOC) Content = 100%, 750 gm/L
Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 57 to 91.5 Wt.% (ASTM D-3257), C6-C11 Aromatic Hydrocarbons Content = 6 to 25 Wt.% (ASTM D-2267), Olefin Hydrocarbons Content = 3.5 to 18 Wt.% (ASTM D-1319), Average Density at 60°F = 5.827 lbs/gal (ASTM D-2161), Dry Point Temperature = 425°F (218°C) (ASTM D-86), Evaporation Rate = 8 to 10 when n-Butyl acetate = 1.0, Sulfur Content = <0.05 Wt.% (ASTM D-2922); Heat Value = 19,500 to 21,000 Btu				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	No substances are readily identified from composition, but, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Full-Range Catalytic Reformed Naphtha (Petroleum)

VAPOR	(LC ₅₀)	Acute	>5,220 mg/L (Rat screen level) (4 hours) - No deaths
ORAL	(LD ₅₀)	Acute	6,620 mg/kg (Male Rat) - Diarrhea, somnolence, and hyperactivity
ORAL	(LD ₅₀)	Acute	5,390 mg/kg (Female Rat) - Diarrhea, somnolence, and hyperactivity
DERMAL	(LD ₅₀)	Acute	>2,000 mg/kg (Rabbit screen level)
DRAIZE EYE		Acute	Mild to moderate eye irritant (Rabbit).
DRAIZE DERMAL		Acute	Moderate to severe skin irritant (Rabbit)
BUEHLER DERMAL		Acute	Non-sensitizing (Guinea Pig)
MUTAGENICITY			
	modified Ames Assay		Negative (Salmonella typhimurium)
	in-vivo Bone Marrow Assay		Negative (Rat)
	in-vitro Lymphoma Assay		Positive with and negative without S9 activation (Mouse)

UNLEADED GASOLINE (a similar material):

VAPOR	(TE _{LO})	Acute	140 ppm (Human) (8 hours) - Mild eye irritant ¹
VAPOR	(TE _{LO})	Acute	500 ppm (Human) (1 hour) - Moderate eye irritant ¹
VAPOR	(TC _{LO})	Acute	900 ppm (Human) (1 hour) - CNS and pulmonary effects
DERMAL	(TD _{LO})	Acute	53 mg/kg (Human) - Skin allergy effects.
VAPOR	(LC ₅₀)	Acute	101,200 ppm (Rat, Mouse, & Guinea Pig) (5 minutes)

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

In a large epidemiological study on over 15,000 persons, no increased risk of kidney cancer was seen in association with **gasoline** exposures for employees at several petroleum refineries or amongst residents located near these refineries. In another study, no increased risk of kidney cancer was seen amongst petroleum refinery workers, but there was a slight trend in kidney cancers among service station employees, especially after a 30-year latency period.

Two-year inhalation toxicity studies with **fully vaporized unleaded gasoline** (at 67, 292, & 2,056 ppm in air) produced kidney damage and kidney tumors in male rats, but not in female rats or mice of either sex. Female mice developed a slightly higher incidence of liver tumors compared to controls at the highest concentration. Results from subsequent scientific studies suggest that the kidney damage, and probably the kidney tumor response, is unique to the male rat. An EPA draft policy statement takes account of alpha-2u-globulin findings as a basis for discarding male rat kidney data in determining whether gasoline is a carcinogen. In additional rat studies, the maternal and developmental NOAEL was determined to be 9,000 ppm (75% of the LEL value). Under conditions of the study, **volatilized unleaded gasoline vapor** did NOT produce evidence of any type of developmental toxicity.

There were no benzene-induced blood toxin or leukemia effects noted in laboratory animals following long-term exposures to **fully-volatilized unleaded gasoline vapor containing 2 vol.% benzene**. However, the relative risk to humans for benzene in gasoline is still unknown.

An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects, however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Intentional abuse of products containing n-hexane have been associated with permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially among women. Chronic repeated or prolonged overexposure to n-hexane, either by inhalation or skin absorption, has been associated with peripheral neuropathy in both human workers and rodents. The neurotoxic properties of n-hexane may increase with concurrent exposure to methyl ethyl ketone, methyl isobutyl ketone or toluene. n-Hexane has been associated with testicular degeneration and epididymal lesions in rats. Also, n-hexane produced fetal toxicity and reduced fetal weight in mice at maternally toxic doses.

Other **hexane isomers** can cause eye and skin irritation; but they were not shown to be mutagenic in the Salmonella/microsome (Ames) assay. They are not considered neurotoxic or carcinogenic.

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depression, narcosis, and death at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral routes, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys and brain. Cyclohexane does not act as a promotor for tumors on mice when exposed to dimethylbenzanthracene. Further, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation, however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Prolonged and repeated exposure to high concentrations of benzene is associated with injury to blood forming organs and anemia. Consumption of alcohol may increase the blood

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

system changes related to benzene exposure. It is linked to the development of acute myelogenous leukemia (AML) in humans. NTP, IARC, and OSHA list benzene as carcinogenic to humans. Studies of workers exposed to high levels of benzene have identified humoral and cellular immunity impairment and a decrease in levels of circulating leukocytes. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice. Animal studies have shown testicular effects and alterations in reproductive cycles with some evidence of developmental effects. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity.

n-Heptane is a skin, mucous membrane, and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by either inhalation or dermal exposure. Overexposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans. One occupational exposure study with **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. Polyneuropathy was reversible within a year following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Deliberate long-term inhalation of **toluene** at high concentrations (e.g., glue sniffing) has been associated with reversible liver effects, permanent kidney damage, CNS depression, brain damage, and cardiac (heart muscle) sensitization. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency). In addition, intentional abuse behavior increases the risk for reproductive effects including pre-term delivery, prenatal death and growth retardation. Also, case studies of persons abusing toluene have revealed isolated incidences of birth defects. Long-term inhalation studies with toluene produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness and impaired reaction time in laboratory animals. Also, in long-term laboratory studies, rats exposed to high concentrations (1,200 to 1,400 ppm) of toluene exhibited high-frequency hearing loss. Case studies have reported hearing damage in humans exposed elevated concentrations of toluene and other mixed solvents.

Studies have indicated that children of women who sniffed massive exposures of **toluene** during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic, nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

Overexposure to **xylene isomers** may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage, and narcosis. Effects may be increased by the consumption of ethanol (alcoholic beverages) which impairs clearance from adipose (fat) tissues. Also, ototoxicity has been associated with chronic overexposure to xylene. An inhalation study with laboratory rats also indicated an association between elevated mixed xylene exposures and hearing loss. Lung inflammation and liver damage were identified as health effects in chronic studies using guinea pigs.

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene (dimethylbenzenes)** showed "no evidence of carcinogenicity" Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays Animal inhalation and feeding studies have also associated embryo and fetotoxicity with maternally toxic dose exposures of mixed xylene isomers and ethylbenzene Fetal toxicity included increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes The significance of these animal study results to humans is not known

NTP completed a 2-year inhalation bioassay of **ethylbenzene** in rodents The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm No significant effects were observed at the 75 and 200 ppm levels However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm Its TC₁₀ for humans 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation studies with rats, four of ten animals died after exposures of 2,400 ppm for 24 hours An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. **Mesitylene (1,3,5-Trimethylbenzene)** inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

Indene and ethylmethylbenzenes are primary skin irritants Overexposure has been associated with kidney damage and increased blood cholinesterase levels. In inhalation developmental studies, indene and other **C9 aromatic hydrocarbons** have been associated with decreased fetal and newborn pup weights

Naphthalene is a potential irritant to eyes, skin and lungs Ingestion of naphthalene has been associated with severe red blood cell and liver damage leading to death Following prolonged or repeated exposures, naphthalene has been shown to cause cataracts, optical neuritis, hemolytic and aplastic anemia, kidney damage (jaundice), and possibly neurotoxicity In animal studies, naphthalene caused fetal effects and decreased spleen weights in pregnant female mice In an NTP sponsored study, naphthalene produced a dose related increase in tumors at the 30 and 60 ppm exposure level in both male and female rats Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas and non-neoplastic lesions of the nose were observed as compared to controls. Cytogenic studies with Chinese hamster ovary cells have demonstrated sister chromatid exchanges and chromosomal aberrations The relevance of these studies to human health is unclear

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life This material will normally evaporate rapidly if spilled If released, volatile **aromatic hydrocarbon components (benzene, toluene, xylenes, ethylbenzene, cumene, and trimethylbenzenes)** may contribute to the creation of atmospheric smog The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days Photooxidation of **isobutane and n-butane** in air (<8%) is not considered to be environmentally significant **Isopentane, n-pentane, n-hexane, hexane isomers, n-heptane, heptane isomers, and iso-octane** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

Toluene has a half-life of from 3 hours to slightly over 1 day and **cyclohexane** has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present

This material is potentially toxic to freshwater and saltwater ecosystems. Using Rainbow Trout (*Salmo irideus*), various Gasolines showed an LC100 (the Lethal Level) from 40 ppm to 100 ppm in ambient stream water. A 24-hour TLm (Median Toxic Limit) resulted in 90 ppm when using juvenile American Shad (*Squalius cephalus*). Using Bluegill Sunfish (*Lepomis macrochirus*), Grey Mullet (*Chelon labrosus*), and Gulf Menhaden (*Brevoortia patronus*), Gasoline showed a 96-hour LC50 of 8 ppm, 2 ppm, and 2 ppm, respectively.

Environmental Fate

This material is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Petroleum distillates, n.o.s. (Hexanes, Heptanes)		
Hazard Class	DOT Class 3 (Flammable liquid)	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Cyclohexane, Benzene, and/or Xylenes.		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 68
		MARPOL III Status	All impacted components were delisted as DOT "Marine Pollutants" per 66 FR 120 (page 33413) dated 6/21/2001

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2 This material would be classified under the following hazard categories Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313 n-Hexane [CAS No. 110-54-3] concentration: 10 to 25% Cyclohexane [CAS No. 110-82-7] concentration: 5 to 15% Benzene [CAS No. 71-43-2] concentration: 0.1 to 1% Toluene [CAS No. 108-88-3] concentration: 1 to 4% Xylenes [CAS No. 1330-20-7] concentration: 1 to 5% Ethylbenzene [CAS No. 100-41-4] concentration: 0.2 to 1% Cumene [CAS No. 92-82-8] concentration: 0 to 2% 1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 95-63-6] concentration: 0.5 to 1.5% Naphthalene [CAS No. 91-20-3] concentration: 0.1 to 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4 As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this material which are subject to this statute are. n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 10 to 25% Cyclohexane [CAS No. 110-82-7] (RQ = 1,000 lbs. [453.6 kg]) concentration: 5 to 15% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 1% Toluene [CAS No. 108-88-3] (RQ = 1,000 lbs. [453.6 kg]) concentration: 1 to 4% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1,000 lbs. [453.6 kg]) conc.: 1 to 7% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 5% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.2 to 1% Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0 to 2% Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 2%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA) Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802
California Proposition 65	This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act Because it contains detectable amounts of Cyclohexane [CAS No. 110-82-7] , this product might be subject to US EPA's one-time only per country export notification requirements

Full-Range Reformate Naphtha (C4-C12 Hydrocarbons)

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare" **1-Butene [CAS No. 106-98-9], Isobutylene [CAS No. 115-11-7], Isopentane [CAS No. 78-78-4], 1-Pentene [CAS No. 109-67-1], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 71-43-2], Methylcyclohexane [CAS No. 108-87-2], Toluene [CAS No. 108-88-3], Xylenes [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], and Cumene [CAS No. 98-82-8].**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Isobutane (Propane, 2-methyl), various Butenes, n-Butane, Isopentane (Butane, 2-methyl), various Pentenes, and n-Pentane.**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 10/19/2001
Print Date Printed on 10/19/2001

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0124
Revision Date 09/08/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquefied Gas/Liquid.
Color Transparent, colorless **Odor** Light hydrocarbon

DANGER! Extremely flammable gas/liquid;
vapor may cause flash fire or explosion!
High pressure and rapid diffusion hazard!
High concentrations of vapor reduce oxygen available for breathing!
Mist or vapor may irritate the eyes, mucous membranes, and/or respiratory tract!
Liquid contact may cause minimal to moderate eye irritation and/or mild to severe skin irritation or frostbite to freeze burns!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss, and/or liver, kidney, or peripheral nervous system damage!
May be harmful or fatal if ingested! Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Potential cancer hazard! Contains low levels of Benzene!
May cause leukemia and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
Based upon animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Light Straight-run Naphtha (C4-C10 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	064741464*	Medical Emergency	(918) 495-4700
CAS Number	64741-46-4	CHEMTREC Emergency	(800) 424-9300
Product Family	C4-C10 Petroleum Hydrocarbons		
Synonyms	Light Straight-run Naphtha (Petroleum); Crude Distillation Unit Light Naphtha; Refinery Crude Tower Light Naphtha; Raw Light Gasoline; Untreated Light Naphtha or Light Gasoline; C4-C10 Solvent; C4-C10 Naphtha.		

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Light Straight-run Naphtha (Petroleum)	64741-46-4	100
2) Butanes	Mixture	1-15
3) Pentanes	Mixture	10-25
4) Cyclopentane	287-92-3	0.5-1.5
5) Hexane Isomers	Mixture	5-15
6) Methylcyclopentane	96-37-7	1-3
7) n-Hexane	110-54-3	5-10
8) Cyclohexane	110-82-7	1-3
9) Benzene	71-43-2	1-2
10) Heptanes	Mixture	10-20
11) Methylcyclohexane	108-87-2	1-5
12) Toluene	108-88-3	1-3
13) Octanes	Mixture	5-20
14) Xylene, Mixed Isomers	1330-20-7	1-2
15) Nonanes	Mixture	1-10
16) Trimethylbenzene (mixed isomers)	25551-13-7	0.5-1.5
17) C10 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	1-3

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Components of this liquefied gas/naphtha may produce mild narcotic effects. High concentrations of this mixture can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Breathing vapors may also cause upper respiratory tract irritation and/or central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, vomiting, visual disturbances, memory loss, confusion, vertigo, drowsiness, fatigue, rapid or difficult breathing, muscular weakness, loss of consciousness, convulsions, coma, and even death, depending upon level of concentration and/or duration of exposure. Approximately 20,000 ppm (or 2 vol.%) of the vapor in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 to 10,000 ppm for only 5 minutes.
Eye Contact	Direct contact with the pressurized or liquefied gas portion of this material may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Animal test results on similar materials and actual human exposures suggest that this product can cause minimal to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Direct contact with the liquefied/pressurized gas portion of this material may produce severe and possibly permanent skin damage from frostbite or freeze burns. Animal test results on similar substances and its components suggest that this material can cause mild to severe skin irritation. Short-term contact symptoms include redness, itching, and burning or blistering of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	Due to its volatile nature, ingestion is not normally an applicable route of exposure for this liquefied gas/naphtha. However, if swallowed, this material may cause a "freeze burn" or irritation with a burning sensation of the mucous membranes in the mouth, throat, and esophagus. The liquid portion of this material can be readily absorbed by the stomach and intestinal tract. Symptoms include nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Chronic Health Effects Summary

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational **toluene** and **xylene** exposures have caused auditory nerve degeneration

Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Also, reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome") Intentional misuse by deliberately concentrating and inhaling this material may be harmful or fatal.

Even with acute exposures, **n-hexane** is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, **2,5-hexanedione**, has been shown to cause degeneration of the testes.

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML) Benzene is also capable of causing changes in genetic material (chromosomes) Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylenes and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period And, the **C9 aromatic hydrocarbons (trimethylbenzenes and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing nervous system disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material. They should take additional precautions to minimize or avoid exposure.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

The substance is toxic to lungs, nervous system, especially the auditory and peripheral nerves, brain, mucous membranes, skin, eyes, and possibly, the heart, blood, liver, kidneys, thymus, and reproductive systems.

Carcinogenic Potential

This stream contains benzene at concentrations above 0.1% **Benzene** is considered carcinogenic by OSHA, IARC, and NTP. (See Section 11)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910 1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.</p> <p>If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p> <p>Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable!		
Flash Point/Method	CLOSED CUP -46° to -43°C (-50° to -45°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.2 %	Upper Flammable Limit	AP 7.6 %
Auto-Ignition Temp.	AP 232°C (450°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors		
Special Properties	Extremely Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Extinguishing Media	SMALL FIRE Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen) LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquefied Gas/Naphtha¹ Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors.

Caution: Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of its vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This liquefied gas or waste mixtures containing this material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

Odor is an inadequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Do not allow vaporizing material to contact eyes, skin, or other tissues. Never siphon by mouth. Prevent contact with food, chewing, or smoking materials. Do not take internally.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of gas/naphthas. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below), then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gas/liquid mixtures. If this material is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Suitable eye wash water should be readily available.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gas/liquid mixtures. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).

General Comments

Releases of this liquefied gas/naphtha may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Liquefied Petroleum Gases	TWA 1000 (ppm) from ACGIH (TLV) [1999] TWA 1000 (ppm) from OSHA (PEL) [1989]
2) Gasoline ("A3" Animal Carcinogen)	TWA 300 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA 300 STEL: 500 (ppm) from OSHA (PEL) [1989]
3) Petroleum Distillates (Naphtha)	TWA 400 (ppm) from OSHA (PEL) [1989] TWA 500 (ppm) from OSHA (PEL) [1976]
4) Butane	TWA 800 (ppm) from ACGIH (TLV) [1999] TWA 800 (ppm) from OSHA (PEL) [1989]
5) Pentane, all isomers	TWA 600 (ppm) from ACGIH (TLV) [1999] TWA 600 STEL: 750 (ppm) from OSHA (PEL) [1989] TWA 1000 (ppm) from OSHA (PEL) [1976]
6) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) [1999] TWA: 600 (ppm) from OSHA (PEL) [1989]
7) Hexane, other isomers	TWA 500 STEL 1000 (ppm) from ACGIH (TLV) [1999] TWA: 500 STEL 1000 (ppm) from OSHA (PEL) [1989]
8) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 50 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
9) Cyclohexane	TWA: 300 (ppm) from ACGIH (TLV) [1999] TWA: 200 STEL 400 (ppm) from ACGIH (TLV) [Proposed for 2000] TWA: 300 (ppm) from OSHA (PEL) [1976]
10) Heptane (n-Heptane)	TWA: 400 STEL 500 (ppm) from ACGIH (TLV) [1999] TWA: 400 STEL 500 (ppm) from OSHA (PEL) [1989] TWA 500 (ppm) from OSHA (PEL) [1976]
11) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) [1999] TWA: 400 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
12) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 1 STEL 5 AL 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
13) Toluene ("A4" = Not Classifiable)	TWA 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA 100 STEL: 150 (ppm) from OSHA (PEL) [1989] TWA: 200 CEIL 300 (ppm) from OSHA (PEL) [1976]
14) Octane, all isomers	TWA 300 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
15) Xylene, Mixed Isomers ("A4" = Not Classifiable)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1999] TWA 100 STEL: 150 (ppm) from OSHA (PEL) [1989]
16) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) [1999] TWA 200 (ppm) from OSHA (PEL) [1989]
17) Trimethylbenzene (mixed isomers)	TWA 25 (ppm) from ACGIH (TLV) [1999] TWA 25 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquefied Gas/Liquid.	Color	Transparent, colorless	Odor	Light hydrocarbon.
Specific Gravity	0.70-0.73 (Water = 1)	pH	Not applicable	Vapor Density	2.5-2.9 (Air = 1)
Boiling Point/Range	-24° to 180°C (-12° to 356°F) (ASTM D-2887)	Melting/Freezing Point			-160° to 7°C (-256° to 45°F)
Vapor Pressure	150 to 175 mm Hg at 20°C (68°F) or 10 to 15 Reid-psi at 40°C (104°F).	Viscosity (cSt @ 40°C)			0.5 to 1.5
Solubility in Water	Slightly soluble in cold water (AP 0.1%).	Volatile Characteristics			Volatile Organic Compounds (VOCs) Content = 100%; AP 675 gm/L This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Additional Properties Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 90 to 96 Wt.% (ASTM D-3257);
C6-C10 Aromatic Hydrocarbons Content = 4 to 10 Wt.% (ASTM D-2267),
Olefin Hydrocarbons Content = LT 1 Wt.% (ASTM D-1019);
Average Density at 60°F = 5.952 lbs./gal. (ASTM D-2161);
Dry Point Temperature = 350°F (177°C) (ASTM D-86),
Evaporation Rate = 10 to 15 when n-Butyl acetate = 1.0;
Heat Value = 19,000 to 20,000 Btu

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability Stable. **Hazardous Polymerization** Not expected to occur

Conditions to Avoid Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.

Materials Incompatibility Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen. n-Heptane will dissolve some plastics.

Hazardous Decomposition Products No substances are readily identified from composition, but, no degradation data is available.

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

When a 4-hour rabbit inhalation screen test was run on liquefied petroleum gas, no deaths occurred, however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An n-butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, n-pentane caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of isobutane and n-butane in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of isobutane may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of butane and butylenes (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of isopentane or n-pentane have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of n-pentane for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both isopentane and n-pentane using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Intentional sniffing abuse of n-hexane has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to n-hexane, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (polyneuropathy). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane may be increased by concurrent exposure to methyl ethyl ketone, methyl isobutyl ketone, and/or toluene.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic. n-Hexane is NOT a tumor promotor in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. n-Hexane, or its metabolite 2,5-hexanedione, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Cyclohexane is an eye, skin, and mucous membrane irritant, CNS depressant, and causes narcosis at high concentrations in air. There is a narrow margin between narcosis, loss of reflexes, and death. In experimental animals exposed to lethal concentrations by inhalation or oral route, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys, and brain. Cyclohexane does not act as a promoter for tumors on mice when exposed to dimethylbenzanthracene, and, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation; however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is irritating to skin and readily absorbed by either inhalation or dermal exposure. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. Repeated direct skin application can produce defatting dermatitis. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (LT 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This material will normally evaporate rapidly if spilled. If released, volatile **aromatic hydrocarbon components (benzene, toluene, xylenes, and ethylbenzene)** may contribute to the creation of atmospheric smog. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **isobutane** and **n-butane** in air (LT 8%) is not considered to be environmentally significant. **Isopentane, n-pentane, n-hexane, hexane isomers, n-heptane, heptane isomers, and iso-octane** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. **Toluene** has a half-life of from 3 hours to slightly over 1 day and **cyclohexane** has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. 24-hour TLms resulted in 2,990 ppm and 250 ppm when using Bluegill Sunfish (*Lepomis macrochirus*) and juvenile American Shad (*Squalius cephalus*), respectively.

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

24-hour and 96-hour LC50s for **cyclohexane** and **toluene** produced results from 25 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), **toluene** showed 24-hour TLms of from 100 ppm to 200 ppm. Using Mosquito Fish (*Gambusia affinis*), **cyclohexane** showed a 24-hour TLM of 15,500 ppm and **n-heptane** showed a 24-hour TLM of 4,925 ppm and a LC100 of 10,000 ppm in turbid fresh water. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Pentanes, Hexanes)		
Hazard Class	Class 3 Flammable liquid.	Packing Group(s)	PG I
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this product which might require DOT HAZMAT bill-of-lading display are Xylenes and Benzene		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

**Light Straight-run Naphtha
(C4-C10 Hydrocarbons)**

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: n-Hexane [CAS No. 110-54-3] concentration: 5 to 10% Cyclohexane [CAS No. 110-82-7] concentration: 1 to 3% Benzene [CAS No. 71-43-2] concentration: 1 to 2% Toluene [CAS No. 108-88-3] concentration: 1 to 3% Xylenes [CAS No. 1330-20-7] concentration: 1 to 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this product which are subject to this statute are: n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 5 to 10% Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 3% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 1 to 2% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 3% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 1 to 4% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 2% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.1 to 0.95% Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0 to 0.25%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13) This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of Methylcyclopentane [CAS No. 96-37-7], Cyclohexane [CAS No. 110-82-7], n-Propylbenzene [CAS No. 103-65-1], Cumene [CAS No. 98-82-8], and other C9 Aromatic Hydrocarbons , this product might be subject to US EPA's one-time only per country export notification requirements In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare". Isopentane [CAS No. 78-78-4], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 71-43-2], Methylcyclohexane [CAS No. 108-87-2], Toluene [CAS No. 108-88-3], Xylenes [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], and Cumene (Isopropylbenzene) [CAS No. 98-82-8].

Light Straight-run Naphtha (C4-C10 Hydrocarbons)

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are:
Isobutane (Propane, 2-methyl), n-Butane, Isopentane (Butane, 2-methyl), and n-Pentane

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3 0
Revision Date 09/08/1999
Print Date Printed on 10/11/1999.

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

MATERIAL SAFETY DATA SHEET

SOUR HYDRODESULFURIZED NAPHTHA (C4-C12 HYDROCARBONS)

MSDS No
RS 127Rev. Date
09/01/89

LYONDELL-CITGO REFINING COMPANY, LTD.
12000 LAWDALE AVENUE
P. O. BOX 2451
HOUSTON, TEXAS 77252-2451

IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product.

This product is considered a hazardous chemical under the OSHA Hazard Communication Rule.

I. General			
Trade Name	SOUR HYDRODESULFURIZED NAPHTHA (C4-C12 HYDROCARBONS)	Telephone Numbers	
Other Names	HDS SOUR NAPHTHA	EMERGENCY 800/424-9300 CHEMTREC 800/313-7645 HOT LINE CUSTOMER SERVICE 800/525-4692 INFO ONLY	
Chemical Family	PETROLEUM HYDROCARBONS	DOT Hazardous Materials Proper Shipping Name PETROLEUM NAPHTHA	
Generic Name	HYDRODESULFURIZED NAPHTHA	DOT Hazard Class 3 (FLAMMABLE LIQUID)	
CAS No.	SEE SECTION IX	Company ID No.	1111111150
		UN/NA ID No.	UN 1255
II. DANGER Summary of Hazards			
<p>EXTREMELY FLAMMABLE! OSHA/NFPA CLASS-IA FLAMMABLE LIQUID. AVOID ALL IGNITION SOURCES. MAY BE HARMFUL IF INHALED OR ABSORBED THROUGH SKIN! AVOID BREATHING MIST OR VAPORS. (SEE SECTIONS IV AND XI FOR OTHER HEALTH EFFECTS.) MAY CAUSE IRRITATION TO EYES, SKIN, AND RESPIRATORY SYSTEM! AVOID LIQUID, MIST, AND VAPOR CONTACT. HARMFUL OR FATAL IF SWALLOWED! CONTAINS PETROLEUM DISTILLATES! IF SWALLOWED DO NOT INDUCE VOMITING SINCE ASPIRATION INTO THE LUNGS MAY CAUSE CHEMICAL PNEUMONIA. OBTAIN PROMPT MEDICAL ATTENTION. CONTAINS BENZENE, A RECOGNIZED HUMAN CARCINOGEN! (SEE SECT. IV. AND XI.) MAY CONTAIN HYDROGEN SULFIDE (H₂S)! A FLAMMABLE, TOXIC AND POTENTIALLY DEADLY GAS. AVOID BREATHING FUMES AND VAPORS (SEE SECTION IV AND XI).</p>			
III. Fire and Explosion			
Flash Point (Method)	AP -45°F (D-56) SEE "FIRE & EXPLOSION HAZARDS"	Autoignition Temperature (Method)	AP 536°F (E-659) BASED ON NFPA "GASOLINE"
		Flammable Limits (% Vol. in Air) At Normal Atmospheric Temperature and Pressure Lower AP 1.4 Upper AP 7.6 BASED ON NFPA "GASOLINE"	
Fire and Explosion Hazards	<p>EXTREMELY FLAMMABLE! THIS MATERIAL RELEASES VAPORS AT OR BELOW AMBIENT TEMPERATURES WHEN MIXED WITH AIR IN CERTAIN PROPORTIONS AND EXPOSED TO AN IGNITION SOURCE, THESE VAPORS CAN BURN IN THE OPEN OR EXPLODE IN CONFINED SPACES BEING HEAVIER THAN AIR, FLAMMABLE VAPORS MAY TRAVEL LONG DISTANCES ALONG THE GROUND BEFORE REACHING A POINT OF IGNITION AND FLASHING BACK.</p>		
Extinguishing Media	<p>FOAM DRY CHEMICAL CO₂ WATER AND/OR WATER FOG MAY COOL THE FIRE BUT MAY NOT EXTINGUISH THE FIRE</p>		<p>HAZARD RATING: 4 - Extreme 3 - High 2 - Moderate 1 - Slight 0 - Insignificant</p> <div style="text-align: center;"> <p>Fire 4, Health 4, Reactivity 0, Special 0</p> </div> <p>* Chronic Health Hazard - See Section IV.</p>
Special Firefighting Procedures	<p>FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER ANY ENCLOSED OR CONFINED FIRE SPACE WITHOUT PROPER PROTECTIVE EQUIPMENT THIS MAY INCLUDE SELF-CONTAINED BREATHING APPARATUS TO PROTECT AGAINST THE HAZARDOUS EFFECTS OF COMBUSTION PRODUCTS AND OXYGEN DEFICIENCIES. COOL TANKS AND CONTAINERS EXPOSED TO FIRE WITH WATER</p>		

IV. Health Hazards

Summary of acute Hazards IRRITATION, TOXIC EFFECTS FROM INHALATION AND SKIN ABSORPTION, RESPIRATORY PARALYSIS AND DEATH, DEPENDING ON CONCENTRATION AND DURATION OF EXPOSURE.

ROUTE OF EXPOSURE	SIGNS AND SYMPTOMS	Primary Route(s)
Inhalation	HYDROGEN SULFIDE IS IRRITATING AND MAY PRODUCE DEATH BY RESPIRATORY PARALYSIS ABOVE 500 PPM. VAPORS OF THIS MATERIAL MAY CAUSE SYMPTOMS OF CNS DEPRESSION DEPENDING ON CONCENTRATION AND DURATION OF EXPOSURE	<input checked="" type="checkbox"/>
Eye Contact	N/DA BUT EYE IRRITATION MAY RESULT FROM CONTACT WITH LIQUID, MIST AND/OR VAPOR. HYDROGEN SULFIDE GAS IS AN EYE IRRITANT.	<input checked="" type="checkbox"/>
Skin Absorption	N/DA; BUT AFTER PROLONGED/REPEATED CONTACT WITH LARGE AMMOUNTS OF THIS MATERIAL, ABSORPTION THROUGH THE SKIN MAY OCCUR AND PRODUCE TOXIC EFFECTS H2S MAY BE ABSORBED THROUGH THE SKIN AND PRODUCE TOXIC EFFECTS.	<input checked="" type="checkbox"/>
Skin Irritation	N/DA BUT SKIN IRRITATION MAY RESULT FROM PROLONGED AND/OR REPEATED SKIN CONTACT	<input checked="" type="checkbox"/>
Ingestion	N/DA; BUT PROBABLY IRRITATION OF MOUTH, THROAT, AND GASTROINTESTINAL TRACT LEADING TO NAUSEA, VOMITING, DIARRHEA, AND RESTLESSNESS. CENTRAL NERVOUS SYSTEM DEPRESSION SIMILAR TO THAT CAUSED BY VAPOR INHALATION.	<input type="checkbox"/>
Summary of Chronic Hazards and Special Health Effects	N/DA; BUT PROLONGED/REPEATED SKIN CONTACT MAY RESULT IN IRRITATION OR MORE SERIOUS SKIN DISORDERS MATERIALS WITH SIMILAR BOILING RANGES AND IDENTIFIED AS PETROLEUM NAPHTHAS HAVE BEEN REPORTED TO INDUCE SKIN TUMORS IN MICE AND KIDNEY DAMAGE IN MALE RATS THIS MATERIAL CONTAINS BENZENE WHICH IS ASSOCIATED WITH LEUKEMIA AND BLOOD DISORDERS (SEE SECTION XI). PERSONNEL WITH PRE-EXISTING CNS DISEASE, SKIN DISORDERS, IMPAIRED LIVER OR KIDNEY FUNCTION, OR CHRONIC RESPIRATORY DISEASES SHOULD AVOID EXPOSURE	

V. Protective Equipment and Other Control Measures

Respiratory	FOR VAPOR/MIST CONCENTRATIONS ABOVE EXPOSURE LIMITS IN SECTION VI, USE A NIOSH/MSHA APPROVED ORGANIC VAPOR/MIST, SUPPLIED-AIR, OR SELF-CONTAINED AIR RESPIRATOR. RESPIRATOR USE SHOULD FOLLOW OSHA 29 CFR 1910.134 OR EQUIVALENT
Eye	INCREASE PROTECTION BEYOND THE NORMAL USE OF SAFETY GLASSES BY WEARING GOGGLES OR FACE SHIELD. CONTACT LENSES SHOULD NOT BE WORN. AN EYE WASH FOUNTAIN SHOULD BE AVAILABLE IN THE VICINITY OF USE
Skin	AVOID PROLONGED AND/OR REPEATED SKIN CONTACT. IF CONDITIONS OR FREQUENCY OF USE MAKE SIGNIFICANT CONTACT LIKELY, CLEAN AND IMPERVIOUS CLOTHING SUCH AS GLOVES, APRON, BOOTS, AND FACIAL PROTECTION SHOULD BE WORN.
Engineering Controls	USE ADEQUATE VENTILATION TO KEEP VAPOR AND MIST CONCENTRATIONS OF THIS MATERIAL BELOW THE OCCUPATIONAL EXPOSURE LIMITS SHOWN IN SECTIONS VI. & XI. ELECTRICAL EQUIPMENT SHOULD FOLLOW NATIONAL ELECTRICAL CODE (NEC) STANDARDS
Other Hygienic and Work Practices	USE GOOD PERSONAL HYGIENE. IN CASE OF SKIN CONTACT, WASH WITH MILD SOAP AND WATER OR A WATERLESS HAND CLEANER. IMMEDIATELY REMOVE SOILED CLOTHING AND WASH THOROUGHLY BEFORE REUSE CLEAN OR DISCARD SOAKED LEATHER GOODS. WASH HANDS WITH PLENTY OF SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USE OF TOILET FACILITIES DO NOT USE SOLVENTS OR HARSH ABRASIVE SKIN CLEANERS.

VI. Occupational Exposure Limits

Substance	Source	Date	Type	Value/Units	Time
V M & P. NAPHTHA (SEE SECTION XI)	ACGIH	1989	TWA	300 PPM	8 HRS
			STEL	400 PPM	15 MIN
BENZENE (TYPE "A2"CARCINOGEN)	ACGIH	1989	TWA	1 PPM	8 HRS

SOUR HYDRODESULFURIZED NAPHTHA (C4-C12 HYDROCARBONS)

MSDS No.
RS 127
Rev. Date
09/01/89

VII. Emergency and First Aid			
Inhalation	IMMEDIATELY MOVE PERSONNEL TO AREA OF FRESH AIR. FOR RESPIRATORY DISTRESS, GIVE AIR, OXYGEN, OR ADMINISTER CPR (CARDIOPULMONARY RESUSCITATION). IF NECESSARY. OBTAIN MEDICAL ATTENTION IF BREATHING DIFFICULTIES CONTINUE		
Eye Contact	FLUSH EYES WITH CLEAN, LOW-PRESSURE WATER FOR AT LEAST 15 MINUTES. OCCASIONALLY LIFTING THE EYELIDS IF PAIN OR REDNESS PERSISTS AFTER FLUSHING, OBTAIN MEDICAL ATTENTION		
Skin Contact	REMOVE CONTAMINATED CLOTHING. REMOVE/BRUSH EXCESS MATERIAL FROM CONTAMINATED AREA; THEN FLUSH SKIN WITH SOAP AND WATER		
Ingestion	RINSE MOUTH WITH WATER. DRINK 1-2 GLASSES OF WATER OR MILK. VOMITING MAY BE INDICATED ON PHYSICIAN DIRECTION/SUPERVISION.		
Emergency Medical Treatment Procedures	NOTE ASPIRATION OF MATERIAL INTO LUNGS MAY CAUSE CHEMICAL PNEUMONIA		
VIII. Spill and Disposal			
Precautions if Material is Spilled or Released	CONTAIN SPILL REMOVE ALL IGNITION SOURCES AND SAFELY STOP FLOW OF SPILL. SPILL MAY CREATE SLIPPING HAZARDS. PREVENT FROM ENTERING ALL BODIES OF WATER, IF POSSIBLE. EVACUATE ALL NON-ESSENTIAL PERSONNEL. IN URBAN AREAS, CLEANUP AS SOON AS POSSIBLE; IN NATURAL ENVIRONMENTS, CLEANUP ON ADVICE FROM ECOLOGISTS. THIS MATERIAL WILL FLOAT ON WATER. ABSORBANT MATERIAL AND PADS CAN BE USED. COMPLY WITH ALL APPLICABLE LAWS. SPILLS MAY NEED TO BE REPORTED TO THE NATIONAL RESPONSE CENTER (800/424-8802). THE SPILLED MATERIAL AND ANY WATER OR SOIL WHICH IT HAS CONTACTED MAY BE HAZARDOUS TO ANIMAL/AQUATIC LIFE		
Waste Disposal Methods	MAXIMIZE PRODUCT RECOVERY FOR REUSE OR RECYCLING. DISPOSE OF WASTE MATERIAL AS EPA "IGNITABLE HAZARDOUS WASTE" (D001), UNLESS PROVEN OTHERWISE. USE APPROVED TREATMENT, TRANSPORTERS AND DISPOSAL SITES IN COMPLIANCE WITH ALL LAWS. IF SPILL IS INTRODUCED INTO A WASTEWATER SYSTEM, THE CHEMICAL AND BIOLOGICAL OXYGEN DEMAND WILL LIKELY INCREASE. SPILL MATERIAL IS BIODEGRADABLE IF GRADUALLY EXPOSED TO MICROORGANISMS. A POTENTIAL DISPOSAL METHOD IS INCINERATION		
IX. Components <small>(This may not be a complete list of components)</small>			
Component Name	CAS No.	Carcinogen##	Composition amount (Vol.) (See Qualification on Page 4)
HYDRODESULFURIZED LIGHT NAPHTHA (PETROLEUM)	64742-73-0*	N/AP AP	0 TO 100 PERCENT
HYDRODESULFURIZED HEAVY NAPHTHA (PETROLEUM)	64742-82-1*	N/AP AP	0 TO 100 PERCENT
BENZENE	71-43-2	1,2,3,4 LT	5 PERCENT
HYDROGEN SULFIDE	7783-06-4	N/AP LT	2 PERCENT
##Listed By: 1 = NTP, 2 = IARC, 3 = OSHA, 4 = Other		Compositions given are typical values, not specifications.	

X. Physical and Chemical Data			
Boiling Point -4° TO 374° F		Viscosity Units, Temp. (Method) N/AP	
Freezing Point LT -150° F		Vapor Pressure (REID-PSIA AT 100° F) AP 5	
Specific Gravity (H ₂ O = 1 at 39.2° F) AP 0.66		Vapor Sp. Gr. (Air = 1.0 at 60°-90° F) AP 4	
Hazardous Polymerization NOT EXPECTED TO OCCUR		Solubility in Water NEGLIGIBLE	
Other Physical and Chemical Properties N/P		pH N/AP	
Appearance and Odor		Stability STABLE	
TRANSPARENT, COLORLESS TO LIGHT YELLOW-COLORED LIQUID; PETROLEUM NAPHTHA ODOR.			
Conditions to Avoid HEAT, SPARKS, AND OPEN FLAME			
Materials to Avoid STRONG ACIDS, ALKALIES, AND OXIDIZERS SUCH AS LIQUID CHLORINE AND OXYGEN.			
Hazardous Decomposition Products BURNING OR EXCESSIVE HEATING MAY PRODUCE CARBON MONOXIDE AND OTHER HARMFUL GASES/VAPORS			
XI. Additional Precautions			

Handling, Storage, and Decontamination Procedures	STORE AND TRANSPORT IN ACCORDANCE WITH ALL APPLICABLE LAWS. KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME! KEEP CONTAINERS CLOSED AND PLAINLY LABELED! GROUND ALL DRUMS AND TRANSFER VESSELS WHEN HANDLING. USE ONLY WITH ADEQUATE VENTILATION! AVOID BREATHING VAPORS. STORE SAMPLES IN A COOL (LT 80° F.) WELL VENTILATED PLACE. THIS STORAGE AREA AND VENTILATION EQUIPMENT SHOULD COMPLY WITH NFPA STANDARDS CLASS-IA/B FLAMMABLE LIQUIDS AND NEC REQUIREMENT.
General Comments	CONTAINS BENZENE A RECOGNIZED HUMAN CARCINOGEN. THE RISK OF BENZENE-INDUCED BLOOD DISORDERS OR CANCER ASSOCIATED WITH THIS MATERIAL IS NOT KNOWN. SOME PETROLEUM NAPHTHAS HAVE BEEN SHOWN TO PRODUCE KIDNEY DAMAGE IN MALE RATS WHICH HAS BEEN ASSOCIATED WITH ISOPARAFFINS, A COMPONENT OF THIS MATERIAL. ALSO, MATERIALS WITH SIMILAR BOILING POINT RANGES AND IDENTIFIED AS "STRAIGHT RUN NAPHTHAS" HAVE INDUCED SKIN TUMORS IN MICE. THE IMPLICATIONS OF THESE STUDIES FOR HUMAN HEALTH EFFECTS IS NOT KNOWN. HYDROGEN SULFIDE CAN CAUSE SYSTEMIC TOXICITY AND RAPID DEATH FROM RESPIRATORY PARALYSIS WHEN EXPOSURES EXCEED 500 PPM. ODOR IS NOT A RELIABLE WARNING OF POSSIBLE OVEREXPOSURE. SINCE SPECIFIC EXPOSURE STANDARDS/CONTROL LIMITS HAVE NOT BEEN ESTABLISHED FOR THIS MATERIAL, THE EXPOSURE LIMITS SHOWN IN SECTION VI. ARE SUGGESTED AS MINIMUM CONTROL GUIDELINES. THE INFORMATION AND CONCLUSIONS HEREIN REFLECT NORMAL OPERATING CONDITIONS AND MAY BE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE MIXTURE ITSELF.
--- Note ---	Qualifications: EQ = Equal AP = Approximately N/P = No Applicable Information Found LT = Less Than UK = Unknown N/AP = Not Applicable GT = Greater Than TR = Trace N/DA = No Data Available

Disclaimer of Liability

The information in this MSDS was obtained from sources which we believe are reliable. **HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS.**

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. **FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.**

This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

SOUR HYDRODESULFURIZED NAPHTHA (C4-C12 HYDROCARBONS)

MSDS No
RS 127
Rev Date
09/01/89**XII.****Regulatory Information****SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), TITLE III**

SECTION 311/312 HAZARD CATEGORIES

IMMEDIATE (ACUTE) HEALTH HAZARD
FIRE HAZARD

DELAYED (CHRONIC) HEALTH HAZARD

SECTION 313

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA
TITLE III, SECTION 313 AND 40 CFR 372
BENZENE**TOXIC SUBSTANCES CONTROL ACT (TSCA)**

ALL COMPONENTS OF THIS PRODUCT ARE LISTED ON THE TSCA INVENTORY.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF CERCLA:

	REPORTABLE QUANTITY (RQ), LBS
BENZENE	10#/4.54KG
HYDROGEN SULFIDE	100#/45.4KG

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 - PROPOSITION 65THIS PRODUCT CONTAINS THE FOLLOWING CHEMICAL(S) LISTED BY THE STATE OF CALIFORNIA AS "KNOWN TO
THE STATE TO CAUSE CANCER"

BENZENE

SOUR HYDRODESULFURIZED NAPHTHA (C4-C12 HYDROCARBONS)

MSL No. RS 127
Rev. Date 09/01/89

XIII Supplement

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BTU Depentanizer Tower Bottoms

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0132
Revision Date 06/15/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid
Color Transparent, colorless **Odor** Light hydrocarbons

DANGER! Extremely flammable liquid;
vapor may cause flash fire or explosion!
May be harmful or fatal if inhaled, ingested or absorbed through the skin!
Mist or vapor may irritate the mucous membranes and respiratory tract!
Liquid contact may cause minimal to moderate eye and/or mild to severe skin irritation and inflammation!
Aspiration into the lungs will cause pulmonary edema and chemical pneumonia!
Overexposures may cause central nervous system (CNS) depression and target organ effects such as lung, brain, cardiopulmonary, blood and blood-forming tissue, liver, kidney, and/or peripheral nervous system damage!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Potential cancer hazard! Contains low levels of Benzene!
May cause leukemia and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
May adversely affect reproduction or reproductive development!
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	BTU Depentanizer Tower Bottoms	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110132	Medical Emergency	(918) 495-4700
CAS Number	64742-89-8 or 8030-30-6	CHEMTREC Emergency	(800) 424-9300
Product Family	C5-C9 Petroleum Hydrocarbons		
Synonyms	732 Unit Depentanizer Tower Bottoms; Benzene/Toluene Unit (BTU) AS-101 Tower Bottoms, BTU (732) Reformer Section Feed, Rubber Solvent Naphtha; Light Naphtha; Light Solvent Naphtha; Ligroine (Petroleum); C5-C9 Hydrocarbon Solvent; C5-C9 Solvent		

BTU Depentanizer Tower Bottoms

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Light Aliphatic Solvent Naphtha (Petroleum)	64742-89-8	100
2) Rubber Solvent (Naphtha)	8030-30-6	100
3) Pentanes	Mixture	1-9
4) Cyclopentane	287-92-3	0.5-4
5) Hexane Isomers	Mixture	5-25
6) Methylcyclopentane	96-37-7	1-15
7) n-Hexane	110-54-3	1-15
8) Cyclohexane	110-82-7	1-8
9) Benzene	71-43-2	1-8
10) Heptanes	Mixture	10-50
11) Methylcyclohexane	108-87-2	1-12
12) Toluene	108-88-3	1-10
13) Octanes	Mixture	1-15
14) Xylenes	1330-20-7	1-5
15) Ethylbenzene	100-41-4	0.2-2
16) Nonanes	Mixture	1-10

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin Contact. Eye Contact. Skin Absorption.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Minimal to moderate eye irritation is expected upon short-term exposure. This is based upon animal test results for a similar product and this product's components.
Skin Contact	Tests on a similar product and this product's components suggest that mild to severe skin irritation, inflammation, and blistering is expected to occur upon short-term contact. Certain components of this material, including n-hexane, cyclohexane, benzene, n-heptane, toluene, iso-octane, and xylenes , may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases.
Ingestion	If swallowed this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium. Additional central nervous system (CNS) effects may occur prior to the onset of convulsions, coma, and death. Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Prolonged and/or repeated contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Chronic inhalation to components of this naphtha (n-pentane, n-heptane, and toluene) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline) -like drugs.

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Even with acute exposures, **n-hexane** is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis.

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing nervous system disease, psychological conditions, skin disorders, impaired hearing, cardiovascular, liver, or kidney function, blood disorders, or chronic respiratory diseases should avoid exposure.

Target Organs

This material is toxic to lungs, nervous system, especially the auditory and peripheral nerves, brain, blood, kidneys, liver, heart, thymus, mucous membranes, skin, eyes, and possibly the reproductive system.

Carcinogenic Potential

This material usually contains benzene in concentrations at or above 0.1%. **Benzene** is considered carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

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If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable!		
Flash Point/Method	CLOSED CUP: -35° to -29°C (-30° to -21°F). (Tagliabue (ASTM D-56))		
Lower Flammable Limit	AP 1.0 %	Upper Flammable Limit	AP 7.5 %
Auto-Ignition Temp.	AP 232°C (450°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	Extremely Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers or waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

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SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits and wear personal protective clothing as shown in Section 8. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store other toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposures, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

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Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSi Z88.2).

General Comments Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Rubber Solvent (Naphtha)	TWA: 400 (ppm) from ACGIH (TLV) [1998]
2) Petroleum Distillates (Naphtha)	TWA: 500 (ppm) from OSHA (PEL) [1976]
3) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) [1998] TWA: 1000 (ppm) from OSHA (PEL) [1976]
4) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) [1998] - SKIN TWA: 500 (ppm) from OSHA (PEL) [1976]
5) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1989]
6) Cyclohexane	TWA: 300 (ppm) from ACGIH (TLV) [1998] TWA: 200 STEL: 400 (ppm) from ACGIH (TLV) [1998] TWA: 300 (ppm) from OSHA [1976]
7) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1998] - SKIN TWA: 1 STEL 5 AL: 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
8) Heptanes	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1976]
9) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1976]
10) Toluene	TWA: 50 (ppm) from ACGIH (TLV) [1998] - SKIN TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
11) Octanes	TWA: 300 STEL: 375 (ppm) from ACGIH (TLV) [1998] TWA: 500 (ppm) from OSHA (PEL) [1976]
12) Xylenes	TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989] TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1998]
13) Ethylbenzene	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [1998] TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [1989]
14) Nonanes	TWA: 200 (ppm) from ACGIH (TLV) [1998] TWA: 200 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, colorless.	Odor	Light hydrocarbons
Specific Gravity	0.69 to 0.71 (Water = 1)	pH	Not applicable.	Vapor Density	3.4 to 3.9 (Air = 1)
Boiling Point/Range	28° to 151°C (82° to 303°F) (ASTM D-2887)	Melting/Freezing Point			-129° to -25°C (-201° to -13°F)
Vapor Pressure	AP 180 mm Hg at 20°C (68°F) or 2 to 5 psia at 100°F (38°C).	Viscosity (cSt @ 40°C)			1 to 2
Solubility in Water	Slightly soluble in cold water (AP 0.03%).	Volatile Characteristics			Volatile Organic Compounds (VOCs) Content = 100%; AP 725 gm/L.
Additional Properties	Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 75 to 97 Wt.% (ASTM D-1319); C6-C8 Aromatic Hydrocarbon Content = 3 to 25 Wt.% (ASTM D-1319); Average Density at 60°F = 5.827 lbs./gal. (ASTM D-2161); Aniline Cloud Point Temperature = AP 140°F (60°C) (ASTM D-611), Kauri-Butanol (KB) Value = AP 35 to 38 (ASTM D-1133); Dry Point Temperature = 292°F (144°C) (ASTM D-86); Evaporation Rate = AP 5 when n-Butyl acetate = 1.0; Heat Value = 18,000 to 19,000 Btu.				

BTU Depentanizer Tower Bottoms

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen. n-Heptane will dissolve some plastics		
Hazardous Decomposition Products	Burning or excessive heating may produce smoke, carbon monoxide, and carbon dioxide; but, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Rubber Solvent (Naphtha) is a minimal to mild eye irritant, mild skin irritant, and non-sensitizer on rabbits and Guinea pigs using standard acute test protocols. And, at a 1.7 mg/L in air concentration, it is a slight eye, nose, and throat irritant for humans. Rats exposed to 1.9, 3.7, and 7.9 mg/L/day of rubber solvent in air for 4 weeks exhibited no ill effects; however, when rabbits were skin painted with 200, 1,000, and 2,000 mg/kg/day for 4 weeks, moderate skin irritation was seen at the lowest dose level and severe irritation at the higher doses. A study using pregnant rodents exposed to 800 and 1,600 ppm of rubber solvent in air for 6 hours/day during days 6 through 15 of gestation showed negative maternal and fetal effects. Rubber solvent produced negative or equivocal mutagenic response in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, and the 8-week dominant lethal assay; however, the IP injection into rat somatic cells assay produced a positive response. The significance of these animal study results to humans is not known.

Inhalation of 500 ppm of **n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **isopentane** and **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (8-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on **n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Intentional sniffing abuse of **n-hexane** has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to **n-hexane**, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (polyneuropathy). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of **n-hexane** may be increased by concurrent exposure to **methyl ethyl ketone, methyl isobutyl ketone, and/or toluene**

n-Hexane is NOT a tumor promotor in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. **n-Hexane**, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days. **Hexane isomers** were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic.

Cyclohexane is an eye, skin, and mucous membrane irritant, CNS depressant, and causes narcosis at high concentrations in air. There is a narrow margin between narcosis, loss of reflexes, and death. In experimental animals exposed to lethal concentrations by inhalation or oral route, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys, and brain. Cyclohexane does not act as a promotor for tumors on mice when exposed to dimethylbenzanthracene; and, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation; however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

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Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children/teenagers have less resistance.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is irritating to skin and readily absorbed by either inhalation or dermal exposure. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. Repeated direct skin application can produce defatting dermatitis. n-Heptane is metabolized to form alcohols and ketones, including neurotoxic 2,5-heptanedione which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of n-heptane of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a 95% purity n-heptane from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, n-heptane and its metabolites were found in low levels (LT 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

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Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may all cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the *Salmonella/microsome* (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **ethylbenzene and the mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay on **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. NTP, IARC, and OSHA have not designated ethylbenzene as a carcinogen.

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If released, volatile aromatic hydrocarbon components (**benzene, toluene, xylenes, and ethylbenzene**) may be released and possibly contribute to the creation of atmospheric smog. **n-Pentane, n-hexane, n-heptane, hexane and heptane isomers, and iso-octane** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. **Toluene and xylenes** have half-lives of from 3 hours to slightly over 1 day and **Cyclohexane** has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

BTU Depentanizer Tower Bottoms**Environmental Fate**

This naphtha is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated with this material might prove to be a potential health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation.		
Proper Shipping Name	Petroleum distillates, n.o.s. (Heptanes, Hexanes)		
Hazard Class	Class 3: Flammable liquid.	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Benzene and Xylenes .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 123 87
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

BTU Depentanizer Tower Bottoms

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as a toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: n-Hexane [CAS No. 110-54-3] concentration: 1 to 15% Cyclohexane [CAS No. 110-82-7] concentration: 1 to 8% Benzene [CAS No. 71-43-2] concentration: 1 to 8% Toluene [CAS No. 108-88-3] concentration: 1 to 10% Xylenes [CAS No. 1330-20-7] concentration: 1 to 5% Ethylbenzene [CAS No. 100-41-4] concentration: 0.2 to 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this material which are subject to this statute are: n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 1 to 15% Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 8% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 1 to 8% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 10% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 1 to 8% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 5% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.2 to 2%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13). This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of Cyclohexane [CAS No. 110-82-7] , this material is subject to US EPA's one-time only per country export notification requirements. In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare: Isopentane [CAS No. 78-78-4], n-Pentane [109-66-0], Cyclohexane [110-82-7], Benzene [71-43-2], Methylcyclohexane [108-87-2], Toluene [108-88-3], Xylenes [1330-20-7], and Ethylbenzene [100-41-4]. In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Chemical substances present in this material which are subject to this statute are: Isopentane (Butane, 2-methyl-) [78-78-4] and n-Pentane [109-66-0]

BTU Depentanizer Tower Bottoms**SECTION 16: OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 06/15/1999
Print Date Printed on 06/29/1999

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0142
HFR#240

Depentanizer OH Accumulator Liquid Draw Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0142
Revision Date 2/21/2005

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Gas/liquid
Color Transparent, colorless. **Odor** Hydrocarbon. Rotten eggs. (Strong.)

DANGER:
EXTREMELY FLAMMABLE LIQUID AND VAPOR, VAPOR MAY CAUSE FLASH FIRE.

Vapor may travel considerable distance to source of ignition and flash back.

Harmful or fatal if swallowed - can enter lungs and cause damage.

Breathing high concentrations can cause irregular heartbeats which may be fatal.

May be harmful if inhaled or absorbed through the skin.

Can cause eye, skin or respiratory tract irritation.

Overexposure can cause central nervous system (CNS) depression and/or other target organ effects.

Harmful to aquatic organisms.

Possible Cancer Hazard (See Section 3)

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Depentanizer OH Accumulator Liquid Draw	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	64741-74-8	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable.		
Synonyms	534 Depent Tower Overhead Accumulator Bottoms, 534 Unit D-23 Accumulator Bottoms, 534 Depent OH Liquid		

SECTION 2. COMPOSITION (TYPICAL)

This product may be composed, in whole or in part, of any of the following refinery streams:

Light Thermal Cracked Naphtha (Petroleum) [CAS No.: 64741-74-8]

This product contains the following chemicals as components of the refinery streams listed above:

Component Name(s)	CAS Registry No.	Concentration (%)
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Depentanizer OH Accumulator Liquid Draw

Hydrocarbons, C5-Rich	68476-55-1	30 - 50
Hexane, other isomers	Mixture	10 - 20
n-Hexane	110-54-3	5 - 15
C6-C9 alpha-Alkenes	68526-99-8	5 - 15
Cyclohexane	110-82-7	1 - 5
Butenes or Butylenes	25167-67-3	1 - 5
Benzene	71-43-2	1 - 3
1, 3-Butadiene	106-99-0	<1
Hydrogen Sulfide	7783-06-4	<0.2

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	<p>May be harmful or fatal if inhaled. Contains hydrogen sulfide. Inhalation of gas or vapor may cause severe nose, throat, respiratory tract, and lung irritation, respiratory paralysis, and death, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath.</p> <p>Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness.</p> <p>Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.</p>
Eye Contact	<p>This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.</p>
Skin Contact	<p>May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact.</p> <p>Skin contact may cause harmful effects in other parts of the body.</p>
Ingestion	<p>Swallowing this material may be harmful.</p> <p>Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea.</p> <p>This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death.</p> <p>Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).</p>

Chronic Health Effects Summary	<p>Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea.</p> <p>Aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated over-exposure such as gasoline and naphtha abusers.</p> <p>Repeated and prolonged overexposure to n-Hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis.</p> <p>This material, or a component of this material, has been shown to cause cancer in laboratory animals. However it is not likely to represent a human cancer hazard.</p> <p>See Toxicological Information (Section 11)</p>
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Conditions Aggravated by Exposure	<p>Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Peripheral Nervous System, Central Nervous System (CNS), Heart (Cardiac)</p>
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Depentanizer OH Accumulator Liquid Draw

Target Organs Contains material which may cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, lymphatic system, peripheral nervous system, upper respiratory tract, immune system, skin, bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

Carcinogenic Potential **CARCINOGENIC EFFECTS** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified + (Proven.) by OSHA+ (Proven.) by NIOSH [1, 3-Butadiene]. Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [1, 3-Butadiene].

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting unless directed to do so by medical personnel -- this material is an aspiration hazard. Get immediate medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

Depentanizer OH Accumulator Liquid Draw

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas.
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)
Lower Flammable Limit	AP 1 % Upper Flammable Limit AP 13 %
Autoignition Temperature	not available
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur and/or nitrogen.
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid enter sewers or waterways.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free

Depentanizer OH Accumulator Liquid Draw

liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Do NOT use compressed air for filling, discharging or other handling operations.

Product container is not designed for elevated pressure. Do not pressurize, cut, weld, braze solder, drill, or grind on containers. Do not expose product containers to flames, sparks, heat or other potential ignition sources. Empty containers may contain product residues that can ignite with explosive force. Observe label precautions. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C). All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable regulatory requirements and the National Electrical Code.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex

Depentanizer OH Accumulator Liquid Draw



- Eye Protection** Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.
- Hand Protection** Avoid skin contact. Use heavy duty gloves constructed of chemical resistant materials such as Viton® or heavy nitrile rubber. Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.
- Body Protection** Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.
- Respiratory Protection** A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
- General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Hydrocarbons, C5-Rich Hexane, other isomers	Not available. ACGIH (United States). TWA: 500 ppm 8 hour(s). STEL: 1000 ppm 15 minute(s).
n-Hexane	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
C6-C9 alpha-Alkenes Cyclohexane	Not available. ACGIH (United States). TWA: 100 ppm 8 hour(s). OSHA (United States). TWA: 300 ppm 8 hour(s).
Butenes or Butylenes Benzene	Not available. ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
1, 3-Butadiene	ACGIH (United States). Notes: "A2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). OSHA (United States). Notes: "Z-2" Suspected Human Carcinogen TWA: 2 ppm 8 hour(s). Action Level: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).
Light Aliphatic Naphthas, Sour (family) Light Catalytic Cracked Naphtha	Not available. Not available.

Depentanizer OH Accumulator Liquid Draw

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas/liquid	Color	Transparent, colorless.	Odor	Hydrocarbon. Rotten eggs. (Strong.)
Specific Gravity	0.65 (Water = 1)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	-12°C (10.4°F)			Melting/Freezing Point	-160°C (-256°F)
Vapor Pressure	Not applicable.			Volatility	650 g/l VOC (w/v)
Solubility in Water				Viscosity (cSt @ 40°C)	not available
Flash Point	Closed cup: <-45°C (-49°F). (Tagliabue.)				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks and flame.		
Materials Incompatibility	Incompatible with strong acids, strong bases, and strong oxidizers.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

n-Hexane

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

Cyclohexane

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Depentanizer OH Accumulator Liquid Draw

Benzene:

ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].
 INHALATION (LC50):
 (VAPOR): Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

1, 3-Butadiene

ORAL (LD50): Acute: 5480 mg/kg [Rat].

Studies of Workers Exposed to Butadiene:

Studies show evidence that over-exposure may be associated with an increased incidence of cancers of lymphohematopoietic organ systems, including leukemia.

Studies in Laboratory Animals:

Studies indicate that prolonged, repeated exposure to high levels of butadiene can cause cancer in multiple organs including lymphohematopoietic organ systems. Studies indicate that exposure to high levels of butadiene can cause chromosome damage to somatic and germ cells. Some studies also show limited evidence that exposure to butadiene may induce heritable mutations. Studies show evidence of adverse effects on male and female reproductive organs following exposure to high levels of butadiene. Embryotoxicity has been reported. Effects included increased rates of fetal death and skeletal variations.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

No data.

Environmental Fate

This product will normally float on water. Components will evaporate rapidly. This material may be harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. The log Kow value for this product is expected to be in the range of 3.3 to 6.

Depentanizer OH Accumulator Liquid Draw

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: n-Hexane [CAS No.: 110-54-3] Concentration: 10% Cyclohexane [CAS No.: 110-82-7] Concentration: 3% Benzene [CAS No.: 71-43-2] Concentration: 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: n-Hexane [CAS No.: 110-54-3] RQ = 5000 lb. (2268 kg) Concentration: 10% Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lb. (453.6 kg) Concentration: 3% Benzene [CAS No.: 71-43-2] RQ = 10 lb. (4.536 kg) Concentration: 2%

Depentanizer OH Accumulator Liquid Draw

Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Benzene: 2% 1, 3-Butadiene: 0.9%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 2/21/2005
Print Date Printed on 2/21/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist:				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0151
Revision Date 2/28/2003

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent, colorless. **Odor** Moderate to strong, sweet and pleasant, aromatic hydrocarbon.

WARNING:

Flammable liquid; vapor may cause flash fire.
Harmful or fatal if swallowed - Can enter lungs and cause damage.
Mist or vapor may irritate the respiratory tract.
Liquid contact may cause eye and skin irritation.
Overexposures may cause central nervous system (CNS) depression and target organ effects.
Spills may create a slipping hazard.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



SECTION 1: IDENTIFICATION

Trade Name	Aromatic Naphtha	Technical Contact	(800) 525-4692
Product Number	2185	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	C8-C11 Aromatic Hydrocarbon Solvent		
Synonyms	Aromatics Distillation Unit (ADU) Xylene Rerun Tower Bottoms Stream and Reboiler Recycle; ADU Ortho-I and Ortho-II Bottom Tower Bottoms Streams and Reboiler Recycles; Feeds to the ADU Ortho Stabilizer Tower; C8-C11 Aromatic Naphtha; C8-C11 Petroleum Hydrocarbons.		

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Xylene, all isomers	1330-20-7	79-99.5
2) C9+ Aromatic Hydrocarbons	70693-06-0	0-21
3) Cumene	98-82-8	0-3
4) Naphthalene	91-20-3	0-3

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Vapors can reduce the oxygen content in air. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	This product can cause eye irritation with short-term contact with liquid, mists or vapor. Symptoms include stinging, watering, redness, and swelling. In severe cases, permanent eye damage can result.
Skin Contact	Tests on similar materials suggest that moderate skin irritation, inflammation, and blistering is expected to occur upon short-term contact. Certain components of this material may be absorbed through the skin. If the skin is damaged, absorption increases.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during swallowing and subsequent vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Also, progressive CNS depression, respiratory insufficiency and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Prolonged and/or repeated contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers.
Conditions Aggravated by Exposure	Personnel with pre-existing central nervous system (CNS) disease, psychological conditions, skin disorders, impaired cardiovascular, liver, or kidney function, or chronic respiratory diseases should avoid exposure.
Target Organs	This material causes damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, brain, upper respiratory tract, skin, eyes, central nervous system (CNS). Contains material which causes damage to the following organs: the nervous system, eye, lens or cornea.
Carcinogenic Potential	This product does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).									
OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory or steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Accordingly, induction of emesis is not recommended. Consider administration of an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p> <p>Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IC flammable liquid.		
Flash Point Method	CLOSED CUP: 32.222°C (90°F).		
Lower Flammable Limit	AP 1 %	Upper Flammable Limit	AP 7 %
Autoignition Temperature	210°C (410°F)		

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, aldehydes and other products of incomplete combustion.
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid enter sewers or waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the **Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13** of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling	A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.
	When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the NFPA National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact. Use gloves (e.g., disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.

Body Protection

Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments

Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

1) Xylene, all isomers	ACGIH (United States). TWA: 100 ppm STEL: 150 ppm OSHA (United States). TWA: 100 ppm
2) Cumene	ACGIH (United States). TWA: 50 ppm OSHA (United States). Skin TWA: 50 ppm
3) Naphthalene	ACGIH (United States, 2000). Skin TWA: 10 ppm STEL: 15 ppm OSHA (United States, 1989). TWA: 10 ppm STEL: 15 ppm TWA: 10 ppm

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color Transparent, colorless.	Odor	Moderate to strong, sweet and pleasant, aromatic hydrocarbon.
Specific Gravity	0.88 (Water = 1)	pH Not applicable.	Vapor Density	4.3 (Air = 1)
Boiling Range	144° C (292° F) to 260° C (500° F)		Melting/Freezing Point	-25°C (-13°F)
Vapor Pressure	The highest known value is 1.1 kPa (8 mmHg) (at 20°C) (Xylene, all isomers).		Viscosity (cSt @ 40°C)	LT 1.5
Solubility in Water	Very slightly soluble in cold water.		Volatile Characteristics	880 g/l VOC (W/V)

Additional Properties No additional information.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.	
Materials Incompatibility	Strong acids, alkalies, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen.	
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.	

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data

Xylene, all isomers:

ORAL (LD50): Acute: 4,300 mg/kg [Rat].

GAS (LC50): Acute: 4,550 ppm for 4 hours [Rat].

DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Also, ototoxicity has been associated with chronic overexposure to xylene. An inhalation study with laboratory rats indicated an association between elevated exposures to mixed xylenes and hearing loss. Animal studies have associated embryo and fetotoxicity with maternally toxic dose exposures of mixed xylene isomers and ethylbenzene. Lung inflammation and liver damage were identified as health effects in chronic studies using guinea pigs. The significance of these animal study results to humans is not known.

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

C9+ Aromatic Hydrocarbons:

C9 aromatic hydrocarbons can cause eye, skin and respiratory irritation. No significant mutagenicity, chromosomal aberrations or neurological effects were observed in evaluations conducted pursuant to a TSCA test rule. A NOEL of 100 ppm was established from developmental toxicity and 3-generation reproductive toxicity studies required under the test rule. Parental toxicity (reduced body weight and food consumption) was present at all exposure levels.

Naphthalene:

ORAL (LD50): Acute: 1800 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig].
 DERMAL (LD50): Acute: 969 mg/kg [Mouse].
 INHALATION (LC50): Acute: >340 mg/m³ 1 hour(s) [Rat].

Naphthalene is a potential irritant to eyes, skin and lungs. Ingestion of naphthalene has been associated with severe red blood cell and liver damage leading to death. Following prolonged or repeated exposures, naphthalene has been shown to cause cataracts, optical neuritis, hemolytic and aplastic anemia, jaundice and possibly neurotoxicity. In animal studies, naphthalene caused fetal effects and decreased spleen weights in pregnant female mice. In an NTP sponsored study, naphthalene produced a dose related increase in tumors at the 30 and 60 ppm exposure level in both male and female rats. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas and non-neoplastic lesions of the nose were observed as compared to controls. Cytogenic studies with Chinese hamster ovary cells have demonstrated sister chromatid exchanges and chromosomal aberrations. The relevance of these studies to human health is unclear.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Analysis for ecological effects has not been conducted on this product. However, if spilled, this product, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Also, the coating action associated with this product can be harmful or fatal to aquatic life and waterfowl. Volatile aromatic components may be released and can possibly contribute to the creation of atmospheric smog.

Environmental Fate

This mixture contains components that are potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds.

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)

SECTION 14: TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Petroleum distillates, n.o.s. (Xylenes)		
Hazard Class	3	Packing Group(s)	III
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this product which require DOT HAZMAT bill-of-lading display are Xylenes and Naphthalene .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 89.3% Cumene [CAS No.: 98-82-8] Concentration: 1.5% Naphthalene [CAS No.: 91-20-3] Concentration: 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 89.3% Cumene [CAS No.: 98-82-8] RQ = 5000 lbs. (2268 kg) Concentration: 1.5% Naphthalene [CAS No.: 91-20-3] RQ = 100 lbs. (45.36 kg) Concentration: 1.5%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Naphthalene: 1.5% Toluene: 0.002%

Light Aromatic Solvent Naphtha (C8-C11 Hydrocarbons)**New Jersey
Right-to-Know Label**

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

**Additional Regulatory
Remarks**

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a from suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.1
Revision Date 2/28/2003
Print Date Printed on 2/28/2003.

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
 ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
 IARC: International Agency for Research on Cancer NTP: National Toxicology Program
 NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
 NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System
 NFPA: National Fire Protection Association EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Light Naphtha Solvent Extract (C6-C8 Aromatic Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0156
Revision Date 08/25/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent, colorless. **Odor** Characteristic, sweet and pleasant, aromatic hydrocarbon.

DANGER! Extremely flammable liquid;
vapor may cause flash fire or explosion!
Mist or vapor may irritate the eyes, mucous membranes,
and respiratory tract!
Liquid contact may cause moderate to severe eye and/or
skin irritation and inflammation!
May be harmful or fatal if ingested!
Aspiration into the lungs will cause pulmonary edema and
chemical pneumonia!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression
and/or target organ effects such as liver, kidney, sensory nerve,
and blood-forming tissue damage!
Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats)!
Cancer hazard; Benzene can cause leukemia and other blood disorders!
May adversely affect reproduction or reproductive development!
Mutagenic hazard; can cause genetic damage!
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Light Naphtha Solvent Extract (C6-C8 Aromatic Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	064741997*	Medical Emergency	(918) 495-4700
CAS Number	64741-99-7	CHEMTREC Emergency	(800) 424-9300
Product Family	C6-C8 Aromatic Hydrocarbons		
Synonyms	BTX Concentrate; BTX Extract, Light Aromatic Concentrate; C6-C8 Alkylbenzenes; C6-C8 Aromatic Hydrocarbon Solvent; Benzene/Toluene/Xylenes/Ethylbenzene Mix		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Light Naphtha Solvent Extract (Petroleum)	64741-99-7	100
2) Benzene	71-43-2	30-64
3) Toluene	108-88-3	25-40
4) Xylenes	1330-20-7	10-25
5) Ethylbenzene	100-41-4	1-5

Light Naphtha Solvent Extract (C6-C8 Aromatic Hydrocarbons)

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation Ingestion.

Signs and Symptoms of Acute Exposure

- Inhalation** Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Vapors can reduce the oxygen content in air Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from an exposure of 5,000 to 10,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces
- Eye Contact** Animal test results on similar materials and actual human exposures to its components suggest that this stream can cause moderate to severe eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling. Direct liquid contact may cause conjunctivitis, corneal burns, and/or permanent clouding of the cornea.
- Skin Contact** Animal test results on similar materials and actual human exposures to its components suggest that this stream can cause moderate to severe skin irritation and inflammation Short-term contact symptoms include redness, itching, and burning of the skin This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above) and target organ effects (see below) If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, lesions, and severe tissue damage.
- Ingestion** If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above)

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. And, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing

Reports have associated repeated and proplonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome") Intentional misuse by deliberately concentrating and inhaling this material may be harmful or fatal. Delirium, seizures, and sudden death have been common results for solvent naphtha abusers

Benzene is considered to be a cancer causing agent It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Repeated overexposure to **toluene** has a cumulative effect on the nervous system which gradually progresses to an irreversible state Besides effects on behavior, memory, coordination, and intelligence, chronic occupational exposures have caused optic and auditory nerve degeneration. And, painters exposed to 100 to 1,000 ppm toluene in air have experienced enlargement of their liver, decreased red and white blood cell counts, and an intolerance to **ethyl alcohol**. Chronic occupational **xylene** exposures have also caused auditory nerve degeneration and resultant hearing loss.

**Light Naphtha Solvent Extract
(C6-C8 Aromatic Hydrocarbons)**

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities. And, based upon animal testing, the **C8 aromatic hydrocarbon components (xylenes and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin or blood disorders, impaired hearing, liver, or kidney function, or chronic respiratory diseases should avoid exposure. Special precautions are necessary for pregnant women and nursing mothers.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians")

Target Organs

The substance is toxic to lungs, central nervous system, brain, blood, bone marrow and other blood-forming tissues, kidneys, liver, heart, mucous membranes, skin, eyes, and possibly the reproductive system.

Carcinogenic Potential

This material contains **benzene** which is considered carcinogenic by OSHA, IARC, and NTP. See Section 11.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation

Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact

Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact

Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion

Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

**Light Naphtha Solvent Extract
(C6-C8 Aromatic Hydrocarbons)**

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid Extremely flammable!		
Flash Point/Method	CLOSED CUP: -12°C (10°F) (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.0%	Upper Flammable Limit	AP 7.1%
Auto-Ignition Temp.	AP 432° to 466°C (810° to 870°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers or waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

**Light Naphtha Solvent Extract
(C6-C8 Aromatic Hydrocarbons)**

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe the vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N F P.A.'s National Electrical Code (NEC)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Chemical splash goggles are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, a hard hat and face shield should also be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable Viton®, PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements for benzene (29 CFR 1910 1028 and 1910 134) or equivalent standard (e.g. ANSI Z88.2).

Light Naphtha Solvent Extract (C6-C8 Aromatic Hydrocarbons)

General Comments Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of **benzene** is several ppm above the occupational exposure guideline levels. Released vapors may cause extremely flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special safety precautions including monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
2) Toluene ("A4" = Not Classifiable)	TWA: 50 (ppm) from ACGIH (TLV) [1998] - SKIN TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
3) Xylene, Mixed Isomers ("A4" = Not Classifiable)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989]
4) Ethylbenzene ("A3" Animal Carcinogen proposed for 2000.)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, colorless.	Odor	Characteristic, sweet and pleasant, aromatic hydrocarbon.
Specific Gravity	0.88 (Water = 1)	pH	Not applicable	Vapor Density	3.0 to 3.2 (Air = 1)
Boiling Point/Range	80° to 81°C (176° to 177°F) (ASTM D-2887)	Melting/Freezing Point			-95° to 6°C (-139° to 42°F)
Vapor Pressure	15 to 76 mm Hg at 20°C (68°F).	Viscosity (cSt @ 40°C)			1 to 2
Solubility in Water	Slightly soluble in cold water (AP 0.06%); miscible with most organic solvents.	Volatile Characteristics			Volatile Organic Compounds (VOCs) Content = 100%; 878 gm/L.
Additional Properties	C6-C8 Aromatic Hydrocarbons Content = 99 to 100 Wt.% (ASTM D-1319), Average Density at 60°F = 7.328 lbs./gal. (ASTM D-2161); Odor Threshold = 4 to 34 ppm in air; Aniline Cloud Point Temperature = 48°F (8.6°C) (ASTM D-611); Kauri-Butanol (KB) Value = 105 (ASTM D-1133); Dry Point Temperature = 292°F (144°C) (ASTM D-86); Evaporation Rate = AP 3.0 when n-Butyl acetate = 1.0; Heat Value = AP 18,000 Btu.				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks, and other ignition sources, strong oxidizing conditions, and freezing temperatures.		
Materials Incompatibility	Strong acids, especially nitric acid, alkalis, and oxidizers such as liquid chlorine, many fluorides, perchlorates, and other halogens, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	Burning or excessive heating may produce smoke, carbon monoxide, and carbon dioxide.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Light Naphtha Solvent Extract (C6-C8 Aromatic Hydrocarbons)

Benzene:

ORAL (LD50):	Acute: 930 mg/kg [Rat] - Tremors and convulsions.
ORAL (LD50):	Acute 4,700 mg/kg [Mouse].
ORAL (LD50):	Acute 5,700 mg/kg [Unidentified mammal].
GAS (LC50):	Acute. 10,000 ppm for 7 hours [Rat].
GAS (LC50):	Acute 9,980 ppm for 8 hours [Mouse] - General anesthesia, muscle weakness, and dyspnea
DERMAL (LD50)	Acute: 48 mg/kg [Mouse]
DERMAL (LD50):	Acute: GT 9,400 uL/kg [Rabbit and Guinea Pig].
INTRAPERITONEAL (LD50):	Acute. 340 mg/kg [Mouse].
INTRAPERITONEAL (LD50):	Acute: 2,890 ug/kg [Rat] - Lung and liver damage plus decreased blood cells.

Toluene

ORAL (LD50):	Acute 636 mg/kg or [Rat].
ORAL (LD50):	Acute: 4,000 mg/kg or [Cat].
GAS (LC50):	Acute 49,000 mg/m ³ for 4 hours [Rat].
GAS (LC50):	Acute. 5,320 ppm for 8 hours [Mouse].
GAS (LC50):	Acute: 400 ppm for 24 hours [Mouse].
DERMAL (LD50):	Acute: 14,100 uL/kg or 12,125 mg/kg [Rabbit]
INTRAVENOUS (LD50):	Acute 1,960 mg/kg [Rat].
INTRAVENOUS (LD50):	Acute: 2,000 mg/kg [Mouse]
SUBCUTANEOUS (LD50):	Acute: 2,250 mg/kg [Mouse]
INTRAPERITONEAL (LD50):	Acute. 59 mg/kg [Mouse].
INTRAPERITONEAL (LD50)	Acute: 500 mg/kg [Guinea Pig].
INTRAPERITONEAL (LD50):	Acute 1,332 mg/kg [Rat].

Xylenes:

ORAL (LD50):	Acute. 4,300 mg/kg [Rat].
GAS (LC50):	Acute 4,550 ppm for 4 hours [Rat].
DERMAL (LD50).	Acute 14,100 uL/kg [Rabbit]
SUBCUTANEOUS (LD50)	Acute: 1,700 mg/kg [Rat]
INTRAPERITONEAL (LD50):	Acute: 2,459 mg/kg [Rat]
INTRAPERITONEAL (LD50):	Acute 1,548 mg/kg [Mouse]

Ethylbenzene:

ORAL (LD50):	Acute: 3,500 mg/kg [Rat].
DERMAL (LD50):	Acute: 17,800 uL/kg [Rabbit].
INTRAPERITONEAL (LD50):	Acute: 2,624 mg/kg [Rat].

Benzene has an IDLH (immediately dangerous to life or health) concentration = 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL) Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes.

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML) Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing Overexposure to benzene has been associated with in chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children and teenagers have a lower resistance to bone marrow poisons

Studies with pregnant laboratory animals have demonstrated that **benzene** is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity

Light Naphtha Solvent Extract (C6-C8 Aromatic Hydrocarbons)

Studies have indicated that children of women who sniffed massive exposures of **toluene** during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **ethylbenzene and the mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

The NTP recently completed a 2-year inhalation bioassay on **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. NTP, IARC, and OSHA have not designated ethylbenzene as a carcinogen.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

If spilled, this material, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. All of this naphtha's components (**benzene, toluene, xylenes, and ethylbenzene**) are volatile and might contribute to the creation of atmospheric smog. Benzene has a half-life of from 4 to 6 hours when photochemically active hydroxyl radicals are present, especially when atmospheres are polluted with nitrogen oxides or sulfur dioxide. Toluene has a half-life of from 3 hours to slightly over 1 day when photochemically active hydroxyl radicals are present, and it is very effectively washed out of the atmosphere by rain.

Light Naphtha Solvent Extract (C6-C8 Aromatic Hydrocarbons)

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), all the components in this naphtha (**benzene, toluene, xylene isomers, and ethylbenzene**) showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), these substances showed 24-hour TLms of from 100 ppm to 400 ppm. Based upon actual spill incident investigations, similar aromatic naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. **Benzene** is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of toluene, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated with this material might prove to be a health hazard.

Recovered non-usable **benzene** is regulated by US EPA as a "listed" hazardous waste (U019) due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Petroleum distillates, n.o.s. (Benzene, Toluene)		
Hazard Class	Class 3: Flammable liquid.	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this product which require DOT HAZMAT bill-of-lading display are Benzene and Toluene		
Placards		Emergency Response Guide No.	130 or 128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

**Light Naphtha Solvent Extract
(C6-C8 Aromatic Hydrocarbons)**

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This stream and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This product contains the following components in concentrations at or above de minimis levels which are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Benzene [CAS No. 71-43-2] concentration: 30 to 64% Toluene [CAS No. 108-88-3] concentration: 25 to 40% Xylenes [CAS No. 1330-20-7] concentration: 10 to 25% Ethylbenzene [CAS No. 100-41-4] concentration: 1 to 5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this refinery stream subject to this statute are: Benzene (RQ = 10 lbs. [4.54 kg]) concentration: 30 to 64% Toluene (RQ = 1000 lbs. [453.6 kg]) concentration: 25 to 40% Xylenes (RQ = 100 lbs. [45.36 kg]) concentration: 10 to 25% Ethylbenzene (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and it is subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13) This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act: Because it might contain small, but detectable, amounts of n-Hexane [CAS No. 110-54-3], Cyclohexane [CAS No. 110-82-7], and/or C9 Aromatic Hydrocarbons , this material might be subject to US EPA's one-time only per country export notification requirements In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3], Xylenes (mixed) [CAS No. 1330-20-7], and Ethylbenzene [CAS No. 100-41-4].

**Light Naphtha Solvent Extract
(C6-C8 Aromatic Hydrocarbons)**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 08/25/1999
Print Date Printed on 02/17/2000.

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****

HFR#441
 BRU/merox unit
 VA Lab
 Hazcom 2
 Maint. 2

Sour LPG/Light Naphtha LEF Overhead Feeds to BRU

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
 12000 Lawndale Avenue
 P.O. Box 2451
 Houston, TX 77252-2451

MSDS No. RS0160
 Revision Date 08/28/2002

Hazard Rankings		
	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Gas/Liquefied Gas/ Liquid Mixture.		
Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg or skunk odor is unreliable as a warning of possible exposure.

DANGER! Extremely flammable and poisonous gas/liquid;
vapor may cause flash fire or explosion.

High pressure and rapid diffusion hazard.

High vapor concentrations reduce oxygen available for breathing.

Contains Hydrogen Sulfide (H₂S) and Mercaptans.

May be harmful or fatal if inhaled or absorbed through the skin.

May cause central nervous system (CNS) depression
or suffocation.

Compressed gas/liquid contact may cause frostbite/freeze burns.

Mist or vapor may cause mild to severe eye, skin, mucous
membrane, and respiratory tract irritation and inflammation.

Aspiration into the lungs will cause pulmonary edema and
chemical pneumonia.

Overexposures may cause central nervous system (CNS)
depression and other target organ effects.

Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats).

Potential cancer hazard. Contains Benzene.

May cause leukemia and/or other blood disorders.

Mutagenic hazard; may cause genetic damage.

May adversely affect reproduction or reproductive development.

Spills may create a slipping hazard. Corrosive to some metals.

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Sour LPG/Light Naphtha LEF Overhead Feeds to BRU	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110160	Medical Emergency	(918) 495-4700
CAS Number	Mixture (See Section 2.)	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Gas/Liquid Phase Mixture of Sour Reformate and LEF Overhead Gases and Light Naphtha		
Synonyms	Mixture of Reformer Stabilizer and Light Ends Fractionator (LEF) Overheads; Feeds to V-33 Accumulator; Feeds to the BRU No. 2 Depropanizer Tower and No. 2, No. 3, and No. 11 Stabilizer Towers; 735 Reformer Stripper and Stabilizer Overhead Streams; 733 Reformer LEF OH Release and Overhead Streams; 734 Coker Naphtha Fractionator (CNF) Overhead Stream; 632 HDS LEF Overhead Stream; LPG/Light Naphtha Blend containing Hydrogen Sulfide and Mercaptans; C3-C8 Hydrocarbons, H ₂ S, and R-SHs.		

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrogen sulfide	7783-06-4	0.1-1
2) Methyl mercaptan	74-93-1	0.01-1
3) Ethyl mercaptan	75-08-1	0-1
4) Ethane	74-84-0	0-2
5) Propane	74-98-6	5-20
6) Butanes	Mixture	30-80
7) Butenes or Butylenes	25167-67-3	0-2
8) Pentanes	Mixture	15-45
9) Cyclopentane	287-92-3	1-15
10) Hexane Isomers	Mixture	10-25
11) Methylcyclopentane	96-37-7	0-6
12) n-Hexane	110-54-3	1-15
13) Cyclohexane	110-82-7	1-5
14) Benzene	71-43-2	0.1-4
15) Methylcyclohexane	108-87-2	0.5-5
16) Heptanes	Mixture	5-15
17) Toluene	108-88-3	0.5-6
18) Octanes	Mixture	0-10

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Eye contact. Skin contact. Skin absorption.

Signs and Symptoms of Acute Exposure

Inhalation

May be harmful or fatal if inhaled! Inhalation of the pressurized gas, vapor, or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. The National Institute for Occupational Safety and Health has determined that atmospheres containing 150 ppm or more of **methyl mercaptan** and 100 ppm or more of **hydrogen sulfide (H₂S)** are immediately dangerous to life and health (IDLH). For **ethyl mercaptan**, the NIOSH IDLH is 500 ppm. At concentrations above 500 ppm, H₂S causes unconsciousness and respiratory paralysis leading to coma and/or death. And, at concentrations above 700 ppm, **methyl mercaptan** may cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)

Additionally, at least one component of this gas/liquid mixture is a "simple asphyxiant". High concentrations of this mixture can displace the amount of oxygen available to breathe below that level necessary to sustain life (hypoxia). Symptoms of asphyxia include increased breathing rate, headache, dizziness, visual disturbances, shortness of breath, nausea, vomiting, confusion, muscular weakness, loss of coordination, convulsions, unconsciousness, coma, and death, depending upon the concentration level and duration of exposure. Oxygen deprivation is possible if working in confined spaces.

Breathing high concentrations of the liquid-phase vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes.

Eye Contact

Vapors may cause mild to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentration of **hydrogen sulfide and mercaptans** and duration of exposure. Direct contact with pressurized/liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn." Direct liquid contact can cause clouding of the cornea with small areas of superficial corneal necrosis.

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

Skin Contact	Direct contact with a liquefied/pressurized gas portion of this material may produce severe and possibly permanent skin damage from frostbite or freeze burns. Tests on this material's components suggest that moderate to severe skin irritation, inflammation, and blistering is expected to occur upon short-term liquid contact. Certain components of this material, including hydrogen sulfide, methyl and ethyl mercaptans, n-hexane, cyclohexane, benzene, n-heptane, toluene, and iso-octane , may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases.
Ingestion	Ingestion of this material is highly unlikely due to its volatile nature. However, if swallowed this material may irritate the mucous membranes of the mouth, throat, and esophagus. The liquid-phase can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium. Additional central nervous system (CNS) effects may occur prior to the onset of convulsions, coma, and death. Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may result in death.
Chronic Health Effects Summary	Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. Methyl and ethyl mercaptans , at low chronic exposures, may cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They have also been shown to produce positive responses in various mutagenic assays. Chronic inhalation to components of this material (propane, n-butane, n-pentane, n-heptane, and toluene) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine (adrenaline)-like drugs . Prolonged and/or repeated liquid or mist contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis. Also, chronic inhalation of light naphtha vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Even with acute exposures, n-hexane is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, 2,5-hexanedione , has been shown to cause degeneration of the testes. Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational toluene exposures have caused auditory nerve degeneration. Available information indicates that toluene is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with eye, skin, cardiovascular, pulmonary, blood, liver, kidney, or neurological disorders, impaired hearing, high blood pressure, and chronic respiratory diseases or those with a compromised ability to use oxygen (asthmatics, anemics, etc.) should take additional precautions to minimize or avoid exposure.
Target Organs	These streams are toxic to eyes, skin, mucous membranes, lungs, central and sympathetic nervous systems, especially the auditory and peripheral nerves, brain, heart, liver, kidneys, thymus, and possibly, the endocrine and reproductive systems.
Carcinogenic Potential	This material contains benzene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP. (See Section 11.)

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry. However, if any liquid is ingested, do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.

Inhalation overexposure can produce other toxic effects due to the mercaptans. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. If seizures occur, administer a benzodiazepine intravenously (Diazepam or Lorazepam) at 4 to 10 mg for an adult or 0.1 to 0.5 mg for a child. Consider use of phenobarbital if seizures recur (30 mg for an adult or a child over 5 years old). For methemoglobinemia symptoms, administer 1 to 2 mg/kg methylene blue slowly intravenously. Additional doses may be required.

This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines such as epinephrine (adrenaline) and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If contact with pressurized gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Extremely flammable! OSHA/NFPA Flammable Gas, Liquefied Gas, and IA Liquid.		
Flash Point Method	CLOSED CUP: AP -107° to -73°C (-160° to -100°F). (Estimated)		
Lower Flammable Limit	1.6 to 4.0%	Upper Flammable Limit	AP 45%
Autoignition Temperature	260° to 288°C (500° to 550°F)		
Hazardous Combustion Products	Carbon dioxide and monoxide, smoke, fumes, oxides of sulfur, and possibly, unburned hydrocarbons or mercaptans.		
Special Properties	This gas/liquid mixture is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Compressed Gas/Liquid Mixture! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors. **Caution:** Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safety stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of their vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. Cover spill with a vapor-suppressing foam as soon as possible. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions.

Sour LPG/Light Naphtha LEF Overhead Feeds to BRU

Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off.

SECTION 7: HANDLING AND STORAGE

Handling

Danger! Poisonous and Flammable Gas! Do NOT breathe vapor; it may contain **hydrogen sulfide (H₂S)**, mercaptans, and/or simple asphyxiants. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow vaporizing material to contact eyes, skin or other tissues, and clothing. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, H₂S concentrations, and flammability.

Refer to applicable OSHA, DOT and local regulation concerning handling, storage, and shipment of mixed petroleum gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. The most common hazard is leakage through faulty pressure regulators. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. The cylinder or other container might even rocket like a missile. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Use a check valve to prevent back-flow into storage containers. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable and poisonous residue.

Storage

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room, and preferably refrigerated. Keep away from all ignition sources! Containers should be able to withstand pressures expected from warming and cooling in storage. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Bond or ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC). The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Sour LPG/Light Naphtha LEF Overhead Feeds to BRU

Eye Protection	Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling high-pressure liquefied gas cylinders and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
Hand Protection	Avoid skin contact and use gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). When handling this material which can produce frostbite or cold burns, use leather gloves over these chemically-resistant gloves. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
Body Protection	Prevent potential skin contact with cold liquid, solid, or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gases and gas/liquids. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	A full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this gas/liquid mixture may create flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Air purifying respirators offer no protection against hydrogen sulfide, mercaptans, and simple asphyxiants

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) TWA: 5 (ppm) from ACGIH (TLV) [Proposed]
2) Methyl mercaptan	TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) TWA: 0.5 (ppm) from ACGIH (TLV) TWA: 0.5 CEIL: 10 (ppm) from OSHA [Proposed] CEIL: 10 (ppm) from OSHA (PEL)
3) Ethyl mercaptan	TWA: 0.5 (ppm) from ACGIH (TLV) TWA: 0.5 CEIL: 10 (ppm) from OSHA (PEL) [Proposed] CEIL: 10 (ppm) from OSHA (PEL)
4) Ethane	Simple asphyxiant.
5) Liquefied Petroleum Gases	TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
6) Propane	TWA: 2500 (ppm) from ACGIH (TLV) TWA: 1000 (ppm) from OSHA (PEL) [Proposed]
7) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
8) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
9) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 (ppm) from OSHA (PEL) [Proposed]
10) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
11) n-Hexane	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 50 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
12) Cyclohexane	TWA: 100 (ppm) from ACGIH (TLV) TWA: 300 (ppm) from OSHA (PEL)
13) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) - SKIN
14) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
15) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL)
16) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
17) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV)

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

17) Octane, all isomers

TWA: 300 (ppm) from ACGIH (TLV)
TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [Proposed]
TWA: 500 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Gas/Liquefied Gas/ Liquid Mixture.	Color	Colorless liquid; invisible gas and vapor; white frost at release point.	Odor	Strong, foul smelling; rotten egg or skunk odor is unreliable as a warning of possible exposure.
Specific Gravity	AP 0.56 to 0.62 (Water = 1)	pH	In the presence of moisture, H ₂ S can convert to H ₂ SO ₄ .	Vapor Density	AP 2.0 to 2.5 (Air = 1)
Boiling Point/Range	AP -89°C to 111°C (-128° to 231°F) [ASTM D-2887]			Melting/Freezing Point	AP -187° to 7°C (-305° to 44°F) at 14.7 psia.
Vapor Pressure	50 to 190 psia at 100°F.			Viscosity (cSt @ 40°C)	Not applicable.
Solubility in Water	Moderately soluble in cold water.			Volatile Characteristics	This material is usually stored as a liquid. If open to the atmosphere, it will evaporate quickly to form a vapor cloud.

Additional Properties This gas' low boiling point intensifies its pressure and rapid diffusion (sudden release) hazard.
Hydrogen Sulfide and Mercaptans Content = 0.1 to 3 Vol.%;
Alkane, Isoparaffin, Alkene, and Cycloalkane Hydrocarbons Content = 87 to 99.3 Wt.% [ASTM D-1319];
C6-C7 Aromatic Hydrocarbon Content = 0.6 to 10 Wt.% [ASTM D-1319];
Average Density at 60°F = < 5.00 lbs./gallon [ASTM D-2161].

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalies, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, calcium hypochlorite, chlorates, permanganates, nitrates, hydrogen peroxide, mercury oxide, and oxygen. Mercaptans and oxidizer mixtures and alkane hydrocarbons and chlorine gas mixtures have produced explosions. Under some conditions, mercaptans may react with water or steam to produce additional toxic and flammable vapors. Methyl and ethyl mercaptans and n-heptane may attack some forms of plastics, coatings, and rubber.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Methanethiol (Methyl mercaptan): GAS (LC₁₀): Acute: 4 ppm for 15 minutes [Human] - Nausea and headache. GAS (LC₅₀): Acute: 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration. GAS (LC₅₀): Acute: 6,530 ug/m³ for 2 hours [Mouse].</p> <p>Ethanethiol (Ethyl mercaptan): GAS (LC₅₀): Acute: 2,770 ppm for 4 hours [Mouse] - Excitment, motor activity changes, and cyanosis. GAS (LC₅₀): Acute: 4,420 ppm for 4 hours [Rat] - Excitment, spastic parapysis, and cyanosis. ORAL (LD₅₀): Acute: 682 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis. INTRAPERITONEAL (LD50): Acute: 226 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.</p> <p>Hydrogen sulfide: GAS (TC₁₀): Acute: 10 ppm for 15 minutes (Human) - Eye irritation. GAS (TC₁₀): Acute: 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation. GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death.</p>
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Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU

GAS (LC₁₀): Acute: 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (> 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Methyl and ethyl mercaptans act as respiratory poisons by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, they can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They are also eye irritants and have been shown to produce positive responses in various mutagenic assays.

Exposure to 1,000 ppm of **propane** for eight hours per day, five days per week, for approximately two weeks produced NO ABNORMAL REACTIONS in humans, including cardiac, pulmonary, or neurologic functions. However, experimental animal testing (dogs) has shown propane overexposures (1 to 10 vol.% in air) may cause the heart to become sensitized to the arrhythmogenic effects of epinephrine-type drugs. Also, when a 4-hour rabbit inhalation screen test was run on **liquefied petroleum gas**, no deaths occurred; however, their heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline). An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic. **n-Hexane** is NOT a tumor promotor in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. **n-Hexane**, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depression, narcosis, and death at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral routes, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys and brain. Cyclohexane does not act as a promotor for tumors on mice when exposed to dimethylbenzanthracene. Further, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation; however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Sour LPG/Light Naphtha LEF Overhead Feeds to BRU

n-Heptane is a skin, mucous membrane, and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by either inhalation or dermal exposure. Overexposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans. One occupational exposure study with **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. Polyneuropathy was reversible within a year following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Prolonged and repeated exposure to high concentrations of benzene is associated with injury to blood forming organs and anemia. Consumption of alcohol may increase the blood system changes related to benzene exposure. It is linked to the development of acute myelogenous leukemia (AML) in humans. NTP, IARC, and OSHA list benzene as carcinogenic to humans. Studies of workers exposed to high levels of benzene have identified humoral and cellular immunity impairment and a decrease in levels of circulating leukocytes. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice. Animal studies have shown testicular effects and alterations in reproductive cycles with some evidence of developmental effects. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Deliberate long-term inhalation of **toluene** at high concentrations (e.g., glue sniffing) has been associated with reversible liver effects, permanent kidney damage, CNS depression, brain damage, and cardiac (heart muscle) sensitization. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency). In addition, intentional abuse behavior increases the risk for reproductive effects including pre-term delivery, prenatal death and growth retardation. Also, case studies of persons abusing toluene have revealed isolated incidences of birth defects. Long-term inhalation studies with toluene produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness and impaired reaction time in laboratory animals. Also, in long-term laboratory studies, rats exposed to high concentrations (1,200 to 1,400 ppm) of toluene exhibited high-frequency hearing loss. Case studies have reported hearing damage in humans exposed elevated concentrations of toluene and other mixed solvents.

Studies have indicated that children of women who sniffed massive exposures of **toluene** during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (Iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. Liquefied gas mixtures will normally evaporate rapidly if spilled. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient temperatures and pressure, the **butenes, hydrogen sulfide, and the mercaptan** components of this material may contribute to generation of atmospheric smog. If released, the **volatile aromatic hydrocarbon components (benzene and toluene)** may also contribute to the creation of atmospheric smog. The atmospheric half-lives of **propane and butenes** under photochemical smog conditions are estimated to be between 5 to 8 hours; and, experimental data shows that significant photooxidation of propylene occurs rapidly within 14 to 21 hours. The atmospheric half-lives of **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of **propane, isobutane, and n-butane** in air (< 8%) are not considered environmentally significant.

Hydrogen sulfide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time. The **pentanes, n-hexane, and hexane isomers** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. **Toluene** has a half-life of from 3 hours to slightly over 1 day and both **cyclopentane and cyclohexane** have a half-lives of from 6 hours to over 4 days when hydroxyl radicals are present.

Ecological effects testing has not been conducted on these streams. If spilled, the naphtha portion of these streams, their storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels. Also, toxic **hydrogen sulfide and the mercaptans** are moderately soluble in water.

Environmental Fate

The naphtha portion of this mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

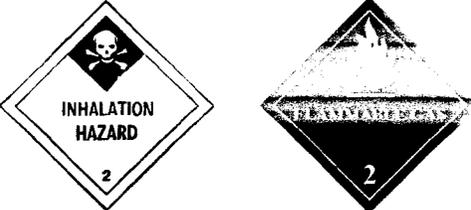
Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by use as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator, if possible and permissible. Venting of this gas/liquid to the atmosphere should be avoided. Maximize material recovery for reuse or recycling.

If spilled and the naphtha portion of this mixture is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase and vapor emissions from the process might prove to be a potential health hazard. The naphtha portion of this mixture is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

SECTION 14: TRANSPORT INFORMATION

DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Liquefied gases, flammable, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Methyl mercaptan)		
Hazard Class	DOT Class: 2.3 (Poisonous gas) and 2.1 (Flammable gas).	Packing Group(s) UN/NA ID	Not applicable. UN1953
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Benzene and Hydrogen sulfide		
Placards			Emergency Response Guide No. 119 HAZMAT STCC No. 49 203 78 MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	<p>The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances which are present in this material and subject to this statute are:</p> <p>Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.1 to 1% Methanethiol (Methyl mercaptan) [CAS No. = 74-93-1] concentration: 0.01 to 1%.</p>
SARA 311/312	<p>The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:</p> <p>Fire, Sudden Release of Pressure, and Acute (Immediate) & Chronic (Delayed) Health Hazards.</p>
SARA 313	<p>This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313:</p> <p>Hydrogen sulfide [CAS No. = 7783-06-4] concentration: 0.1 to 1% Methanethiol (Methyl mercaptan) [CAS No. = 74-93-1] concentration: 0.01 to 1% n-Hexane [CAS No. 110-54-3] concentration: 1 to 15% Cyclohexane [CAS No. 110-82-7] concentration: 1 to 5% Benzene [CAS No. 71-43-2] concentration: 0.1 to 4% Toluene [CAS No. 108-88-3] concentration: 0.5 to 6%.</p>
CERCLA	<p>The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which might be present in this material that are subject to this statute are:</p> <p>Hydrogen sulfide [CAS No. = 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 1% Methanethiol (Methyl mercaptan) [CAS No. = 74-93-1] (RQ = 100 lbs. [45.36 kg]) conc.: 0.01 to 1% n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 1 to 15% Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 1 to 5% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 4% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.5 to 6% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-1] (RQ = 1000 lbs. [453.6 kg]) conc.: 0 to 2%.</p>

**Sour LPG/Light Naphtha
LEF Overhead Feeds to BRU**

CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	These streams contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3] .
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	<p>Under Section 12(b) of the Toxic Substances Control Act: Because it contains detectable amounts of Cyclohexane (CAS No. 110-82-7), this material might be subject to US EPA's one-time only per country export notification requirements.</p> <p>In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components in this material as a "Volatile Organic Compounds (VOC)" which contribute significantly to air pollution which endangers public health and welfare": 1-Butene [CAS No. 106-98-9], Isobutylene [CAS No. 115-11-7], Isopentane [CAS No. 78-78-4], 1-Pentene [CAS No. 109-67-1], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 106-98-9], Methylcyclohexane [CAS No. 108-87-2], and Toluene [CAS No. 108-88-3].</p> <p>In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances which may be present in this material which are subject to this statute include: Hydrogen sulfide, Methyl mercaptan (Methanethiol), Ethyl mercaptan (Ethanethiol), Ethane, Propane, Isobutane (Propane, 2-methyl), various Butenes, n-Butane, Isopentane (Butane, 2-methyl), 2,2-Dimethylpropane (Neopentane), various Pentenes, and n-Pentane.</p>

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 08/28/2002
Print Date Printed on 08/28/2002.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists	AIHA: American Industrial Hygiene Association					
IARC: International Agency for Research on Cancer	NTP: National Toxicology Program					
NIOSH: National Institute of Occupational Safety and Health	OSHA: Occupational Safety and Health Administration					
NPCA: National Paint and Coating Manufacturers Association	HMIS: Hazardous Materials Information System					
NFPA: National Fire Protection Association	EPA: US Environmental Protection Agency					

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Benzene NESHAPS Stripper Tower Overhead

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0165
Revision Date 05/09/2000

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Two-phase Liquid.		
Color	Transparent, colorless to hazy grey	Odor	Characteristic, sweet and pleasant, aromatic hydrocarbon Its odor threshold is 2-5 ppm in air

DANGER! Extremely flammable liquid mixed with pressurized steam; vapor may cause flash fire or explosion!
 Release of vapor/steam reduces oxygen available for breathing!
 Mist or vapor may cause thermal burns on contact or irritate the eyes, mucous membranes, and respiratory tract!
 Liquid contact may cause minimal to severe eye irritation and/or mild to severe skin irritation and inflammation!
 May be harmful if inhaled or absorbed through the skin!
 Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss and/or blood and blood-forming tissue damage!
 May be harmful or fatal if ingested!
 Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
 Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
 Contains Benzene! Cancer hazard; may cause leukemia and other blood disorders! Mutagenic hazard; may cause genetic damage!
 Based upon animal testing, may adversely affect reproduction!
 Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Benzene NESHAPS Stripper Tower Overhead	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	0016500165	Medical Emergency	(918) 495-4700
CAS Number	Mixture	CHEMTREC Emergency	(800) 424-9300
Product Family	C6-C9 Petroleum Hydrocarbons and Pressurized Water Vapor		
Synonyms	438 Unit Overhead Stream, Steam-saturated Recovered Solvent; Steam-saturated Slop Aromatic Naphtha; Reclaimed Aromatic Naphtha and Steam Mixture; Recovered BTX Aromatics and Steam; Light Aromatic Naphtha and Steam; C6-C9 Aromatic Hydrocarbons and Steam Mixture		

**Benzene NESHAPS
Stripper Tower Overhead**

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Water	7732-18-5	10-50
2) Benzene	71-43-2	20-35
3) Heptanes	Mixture	0-3
4) Toluene	108-88-3	15-25
5) Octanes	Mixture	0-3
6) Xylene, Mixed Isomers	1330-20-7	5-20
7) Ethylbenzene	100-41-4	1-5
8) Nonanes	Mixture	0-2
9) n-Propylbenzene	103-65-1	0.5-1.5
10) Cumene	98-82-8	0-1.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from an exposure of 10,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Upon direct contact, hot material may cause severe thermal burns. Animal test results and actual human exposures of this material's components suggest that this product can cause minimal to severe eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Skin contact with hot material may result in severe thermal burns. Animal test results and actual human exposures of this material's components suggest that this product can cause minimal to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, abdominal pain, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Chronic occupational xylene exposures have caused auditory nerve degeneration. Also, chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this naphtha may be harmful or fatal. Available information indicates that toluene is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Benzene NESHAPS Stripper Tower Overhead

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Based upon animal testing, the C8 aromatic hydrocarbon components (xylenes and ethylbenzene) might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period (See Section 11)

Conditions Aggravated by Exposure

Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Special precautions are necessary for pregnant women and nursing mothers.

Exposure to high concentrations of this material may increase the sensitivity of the heart to epinephrine (adrenalin) and catecholamine-like drugs. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

This substance is toxic to lungs, central nervous system, especially the auditory nerve, brain, mucous membranes, skin, eyes, and possibly, the blood, bone marrow and other blood-forming tissues, heart, liver, kidneys, thymus, and reproductive systems.

Carcinogenic Potential

This product contains a benzene component at concentrations at or above 0.1%. Benzene is considered carcinogenic by OSHA, IARC, and NTP. See Section 11

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Benzene NESHAPS Stripper Tower Overhead

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA or IB Flammable Liquid for the hydrocarbon portion of the mixture Non-flammable with steam present to extremely or highly flammable without steam ¹		
Flash Point Method	CLOSED CUP: -11° to 4°C (12° to 40°F) for the Hydrocarbon Portion of the Mixture. (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.0%	Upper Flammable Limit	AP 7.1%
Autoignition Temperature	AP 432°C (810°F) for the Hydrocarbon Portion of the Mixture.		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors		
Special Properties	Flammable Liquid If Steam Is Removed! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

Benzene NESHAPS Stripper Tower Overhead

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

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Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Released vapors may cause extremely flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special safety precautions including monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

1) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 1 STEL: 5 AL 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
2) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
3) Toluene ("A4" = Not Classifiable)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
4) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
5) Xylene, Mixed Isomers ("A4" = Not Classifiable)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989]
6) Ethylbenzene ("A3" Animal Carcinogen proposed for 2000.)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [1989]
7) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) [1999] TWA: 200 (ppm) from OSHA (PEL) [1989]
8) Cumene	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 50 (ppm) from OSHA (PEL) [1989] - SKIN

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Two-phase liquid.	Color	Transparent, colorless to hazy grey.	Odor	Characteristic, sweet and pleasant, aromatic hydrocarbon. Its odor threshold is 2-5 ppm in air.
Specific Gravity	0.86-1.00 (Water = 1)	pH	6.0 to 8.0 for water portion of this mixture	Vapor Density	3.4 to 3.8 (Air = 1)
Boiling Point/Range	80° to 152°C (176° to 306°F)		Melting/Freezing Point		-95° to 13°C (-139° to 55°F)
Vapor Pressure	23 to 43 mm Hg at 20°C (68°F).		Viscosity (cSt @ 40°C)		1 to 2
Solubility in Water	Slightly soluble in cold water (AP 0.1%).		Volatile Characteristics		Volatile Organic Compounds (VOCs) Content = 100%, 875 to 880 gm/L
Additional Properties	The following properties are related to the hydrocarbon portion of this mixture only: C6-C9 Aromatic Hydrocarbon Content = 85 to 99 Wt.% (ASTM D-1319); Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 0 to 15 Wt.% (ASTM D-1319), Average Density at 60°F = 7.269 lbs/gal. (ASTM D-2161), Dry Point Temperature = 292°F (145°C) (ASTM D-86), Evaporation Rate = 1.5 to 4.5 when n-Butyl acetate = 1.0, Heat Value = 17,800 to 18,500 Btu				

**Benzene NESHAPS
Stripper Tower Overhead**

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from heat, sparks, and other ignition sources, strong oxidizing conditions, and freezing temperatures		
Materials Incompatibility	Strong acids, especially nitric acid, alkalis, and oxidizers such as liquid chlorine, many fluorides, perchlorates, and other halogens, hydrogen peroxide, and oxygen n-Heptane will dissolve some plastics		
Hazardous Decomposition Products	No substances are readily identified from composition, but, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data **Benzene and toluene** have IDLH (immediately dangerous to life or health) concentrations = 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with in chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children and teenagers have a lower resistance to bone marrow poisons.

Studies with pregnant laboratory animals have demonstrated that **benzene** is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is irritating to skin and readily absorbed by either inhalation or dermal exposure. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. Repeated direct skin application can produce defatting dermatitis. **n-Heptane** is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans. **n-Heptane** was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with **n-heptane** exposure was reversible within a year following removal of exposure.

Benzene NESHAPS Stripper Tower Overhead

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay on **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level, and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. NTP, IARC, and OSHA have not designated ethylbenzene as a carcinogen.

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days.

Benzene NESHAPS Stripper Tower Overhead

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, the aromatic naphtha components of this mixture, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. All of its **aromatic hydrocarbon components (benzene, toluene, xylene isomers, and ethylbenzene)** are volatile and might contribute to the creation of atmospheric smog. **Toluene** has a half-life of from 3 hours to slightly over 1 day when photochemically active hydroxyl radicals are present; and it is very effectively washed out of the atmosphere by rain. **Benzene** has a half-life of from 4 to 6 hours when photochemically active hydroxyl radicals are present, especially when atmospheres are polluted with nitrogen oxides or sulfur dioxide. **Benzene and toluene** are very effectively washed out of the atmosphere by rain. The **n-heptane, heptane isomers, and iso-octane** all have estimated half-lives of between 2 4 and 4 4 days in air when photochemical hydroxyl and/or nitrate radicals are present.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), all the components in the aromatic naphtha portion of this mixture (**benzene, toluene, xylene isomers, and ethylbenzene**) showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), all these component substances showed 24-hour TLms of from 95 ppm to 400 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This aromatic naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Benzene NESHAPS
Stripper Tower Overhead**

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U S. Department of Transportation (DOT)		
Proper Shipping Name	Petroleum distillates, n.o.s (Benzene, Toluene)		
Hazard Class	Class 3: Flammable liquid	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this product which require DOT HAZMAT bill-of-lading display are Benzene and Toluene		
Placards		Emergency Response Guide No.	130 or 128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This product contains the following components in concentrations that might be at or above de minimis levels and they are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 Benzene [CAS No. 71-43-2] concentration: 25 to 45% Toluene [CAS No. 108-88-3] concentration: 20 to 40% Xylenes [CAS No. 1330-20-7] concentration: 10 to 30% Ethylbenzene [CAS No. 100-41-4] concentration: 2 to 7% Cumene (Isopropylbenzene) [CAS No. 98-82-8] concentration: 0 to 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product subject to this statute are Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 25 to 45% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 20 to 40% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 0 to 2% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 10 to 30% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 2 to 7% Cumene (Isopropylbenzene) [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0 to 2%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material might contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is subject to requirements of California Health & Safety Code Section 25249.5 Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].

Benzene NESHAPS Stripper Tower Overhead

**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2.

**Additional Regulatory
Remarks**

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500 14(b)(3) and 1500 83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

Under Section 12(b) of the Toxic Substances Control Act. Because it contains detectable amounts of **n-Propylbenzene [CAS No. 103-65-1] and other C9 Aromatic Hydrocarbons**, this material might be subject to US EPA's one-time only per country export notification requirements

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare" **Benzene [CAS No. 71-43-2], Toluene [CAS No. 108-88-3], mixed Xylenes [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], and possibly Cumene (Isopropylbenzene) [CAS No. 98-82-8].**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 05/09/2000
Print Date Printed on 05/09/2000

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



B.T. Reform Feed

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0166
Revision Date 01/21/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid		
Color	Transparent, colorless to slightly yellow.	Odor	Light hydrocarbon to sweet aromatic hydrocarbon. Odor threshold is 1 to 7 ppm in air

DANGER! Extremely flammable liquid; vapor may cause flash fire or explosion!
High vapor concentrations reduce oxygen available for breathing!
Mist or vapor may irritate the eyes, nose, and respiratory tract!
Liquid contact may cause mild to moderate eye irritation and/or moderate to severe skin irritation!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss and/or liver, kidney, or peripheral nervous system damage!
May be harmful or fatal if ingested! Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Based upon animal testing, vaporized Gasoline (a similar material) causes tumors! Potential cancer hazard!
Contains low levels of Benzene and Ethylbenzene!
May cause anemia, leukemia, and/or other blood disorders!
Mutagenic hazard; may cause genetic damage!
Based upon animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

Hazard Rankings

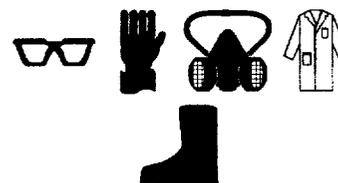
	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements See Section 8 for Details

The personal protective equipment depicted below is recommended for use only at this facility



SECTION 1: IDENTIFICATION

Trade Name	B.T. Reform Feed	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	064741420*	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	64741-42-0	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	C4-C11 Petroleum Hydrocarbons		
Synonyms	Benzene-Toluene Unit Reformer Feed, C4-C11 Naphtha or Gasoline, Full-range Naphtha or Gasoline, Full-range, Straight-run Naphtha (Petroleum)		

B.T. Reform Feed**SECTION 2: COMPOSITION**

Component Name(s)	CAS Registry No.	Concentration (%)
1) Full-range Straight-run Naphtha (Petroleum)	64741-42-0	100
2) Butanes	Mixture	0.5-1.5
3) Pentanes	Mixture	0.5-10
4) Hexane Isomers	Mixture	2-25
5) Methylcyclopentane	96-37-7	1-5
6) n-Hexane	110-54-3	1-15
7) Cyclohexane	110-82-7	1-25
8) Benzene	71-43-2	0.1-7
9) Heptanes	Mixture	5-30
10) Methylcyclohexane	108-87-2	1-15
11) C7-C12 alpha-Alkenes	68855-57-2	0.1-3
12) Toluene	108-88-3	0.5-16
13) Octanes	Mixture	2-30
14) Xylenes (mixed isomers)	1330-20-7	1-15
15) Ethylbenzene	100-41-4	0.3-5
16) Nonanes	Mixture	1-25
17) Cumene	98-82-8	0-2
18) n-Propylbenzene	103-65-1	0.5-2
19) Trimethylbenzene (mixed isomers)	25551-13-7	1-3
20) 1,2,4-Trimethylbenzene (Pseudocumene)	95-63-6	0.5-1.5
21) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-3
22) Indene	95-13-6	0.5-1.5
23) Naphthalene	91-20-3	0.1-3
24) C10-C11 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	1-10
25) C10-C11 Alkylbenzenes	70693-06-0	0-2

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of this mixture's vapor may cause upper respiratory tract irritation, headache, nausea, vomiting, and/or central nervous system (CNS) depression. Components of this mixture may also produce mild narcotic effects. Symptoms may include euphoria, excitation or giddiness, abdominal pain, loss of appetite, fatigue, muscular weakness, and staggering gait. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. High vapor concentrations can displace the amount of oxygen in air available to breathe below that necessary to sustain life (hypoxia), especially if working in confined spaces. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 to 10,000 ppm for only 5 minutes.
Eye Contact	Actual human exposures indicate that this product can cause mild to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling. Liquid contact may cause conjunctivitis, small areas of superficial corneal necrosis, and/or permanent clouding of the cornea.
Skin Contact	Actual human exposures indicate that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning or blistering of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.

B.T. Reform Feed**Ingestion**

Due to its volatile nature, ingestion is not normally an applicable route of exposure. However, if swallowed, this material may cause a "freeze burn" or irritation with a burning sensation of the mucous membranes in the mouth, throat, and esophagus. The liquid portion can be readily absorbed by the stomach and intestinal tract. Symptoms include nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above)

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary

Altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for **gasoline** abusers. Intentional misuse by deliberately concentrating and inhaling this material may be harmful or fatal.

Even with acute exposures, **n-hexane** is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, **n-hexane's** metabolite, **2,5-hexanedione**, has been shown to cause degeneration of the testes.

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational **toluene and xylene** exposures have caused auditory nerve degeneration.

At high exposure concentrations, **ethylbenzene** has been associated with multiple organ tumors in laboratory animals.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylene isomers and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. And, the **C9 aromatic hydrocarbons (cumene, n-propylbenzene, trimethylbenzenes, indene, and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period.

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing nervous system disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material. They should take additional precautions to minimize or avoid exposure.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

The substance is toxic to lungs, nervous system, especially the auditory and peripheral nerves, brain, liver, kidneys, blood and blood-forming tissues, mucous membranes, skin, eyes, and possibly, the heart, thymus, lymph nodes, and reproductive systems.

Carcinogenic Potential

This material contains benzene and ethylbenzene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP and Ethylbenzene are considered possibly carcinogenic to humans by IARC. (See Section 11.)

B.T. Reform Feed

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p> <p>Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid Extremely flammable!		
Flash Point Method	CLOSED CUP -48° to -37°C (-55° to -35°F) (Tagliabue [ASTM D-56])		
Lower Flammable Limit	0.9% in Air.	Upper Flammable Limit	8.5% in Air.
Autoignition Temperature	225° to 275°C (435° to 527°F) by ASTM E-659.		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		

B.T. Reform Feed

Special Properties	<p>Extremely Flammable Liquid¹ This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Mists or sprays may be flammable at temperatures below the flash point. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard if released into confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing middle distillates or other higher flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.</p>
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>
Protection of Fire Fighters	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.</p>

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Liquid¹ Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Eliminate all potential ignition sources because a liquid spill will vaporize rapidly. A vapor-suppressing foam may be used to reduce vapors. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material even when wearing proper respiratory equipment and fire-resistant protective clothing. Do not direct water at the source of leak, but, use water spray to reduce vapors or divert vapor cloud drift. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations. Spills will most likely need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

B.T. Reform Feed**Handling**

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION**Engineering Controls**

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below), then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

The personal protective equipment depicted below is recommended for use only at this facility.

**Eye Protection**

Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent). During transfer operations or when this material is being released under pressure, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with vapors and liquid. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use this material as a skin cleaner.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

B.T. Reform Feed

Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2)

General Comments Releases of this product may create flammable, explosive, and/or oxygen-deficient atmospheres (<19.5 Vol % in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. If the Lower Explosive Limit (LEL) for this product is exceeded, all entry into the contaminated area/confined space should be prohibited. Odor is an inadequate warning for hazardous conditions.

Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Gasoline ("A3" Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) TWA: 300 STEL: 500 (ppm) from OSHA (PEL)
2) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
3) Butane	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
4) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
5) Cyclopentane	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 (ppm) from OSHA (PEL) [Proposed]
6) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
7) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 50 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
8) Cyclohexane	TWA: 300 (ppm) from ACGIH (TLV) TWA: 100 (ppm) from ACGIH (TLV) [Proposed] TWA: 300 (ppm) from OSHA (PEL)
9) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
10) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) TWA: 400 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
11) Benzene ("A1" and "Z-2" Known Human Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) - SKIN
12) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL)
13) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
14) Xylene, mixed isomers	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed]
15) Ethylbenzene ("A3" Animal Carcinogen [Proposed])	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [Proposed]
16) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) TWA: 200 (ppm) from OSHA (PEL) [Proposed]
17) Cumene	TWA: 50 (ppm) from ACGIH (TLV) TWA: 50 (ppm) from OSHA (PEL) - SKIN [Proposed]
18) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) TWA: 25 (ppm) from OSHA (PEL) [Proposed]
19) Indene	TWA: 10 (ppm) from ACGIH (TLV) TWA: 10 (ppm) from OSHA (PEL) [Proposed]
20) Naphthalene	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed] TWA: 10 (ppm) from OSHA (PEL)

B.T. Reform Feed**SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES**

Physical State	Liquid	Color	Transparent, colorless to slightly yellow	Odor	Light hydrocarbon to sweet aromatic hydrocarbon Odor threshold is 1 to 7 ppm in air
Specific Gravity	0.70 to 0.79 (Water = 1)	pH	Not applicable	Vapor Density	2.8 to 3.1 (Air = 1)
Boiling Point/Range	32° to 207°C (90° to 405°F) [ASTM D-86]			Melting/Freezing Point	<-75°C (<-103°F) [ASTM D-97]
Vapor Pressure	2 to 13 mm Hg at 20°C (68°F) or 1 to 7 Reid-psia at 37.8°C (100°F)			Viscosity (cSt @ 40°C)	0.5 to 1.5 [ASTM D-445]
Solubility in Water	Slightly soluble in cold water (<0.2%)			Volatile Characteristics	Volatile Organic Compounds (VOC) Content = 100%, 750 gm/L
Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 52 to 94.5 Wt.% (ASTM D-3257), C6-C11 Aromatic Hydrocarbons Content = 5.5 to 45 Wt.% (ASTM D-2267); Olefin Hydrocarbons Content = 0.1 to 3 Wt.% (ASTM D-1319); Average Density at 60°F = 6.244 lbs/gal (ASTM D-2161); Dry Point Temperature = 400°F (204°C) (ASTM D-86); Evaporation Rate = 8 to 10 when n-Butyl acetate = 1.0; Sulfur Content = <0.075 Wt.% (ASTM D-2922), Heat Value = 19,500 to 21,000 Btu				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; but, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Full-Range Straight-run Naphtha (Petroleum):		
	VAPOR (LC ₅₀):	Acute	>5,220 mg/L (Rat screen level) (4 hours) - No deaths
	ORAL (LD ₅₀):	Acute	6,620 mg/kg (Male Rat) - Diarrhea, somnolence, and hyperactivity
	ORAL (LD ₅₀):	Acute	5,390 mg/kg (Female Rat) - Diarrhea, somnolence, and hyperactivity
	DERMAL (LD ₅₀):	Acute	>2,000 mg/kg (Rabbit screen level)
	DRAIZE EYE	Acute	Mild to moderate eye irritant (Rabbit)
	DRAIZE DERMAL	Acute	Moderate to severe skin irritant (Rabbit)
	BUEHLER DERMAL	Acute	Non-sensitizing (Guinea Pig)
	MUTAGENICITY		
	modified Ames Assay		Negative (Salmonella typhimurium)
	in-vivo Bone Marrow Assay		Negative (Rat)
	in-vitro Lymphoma Assay		Positive with and negative without S9 activation (Mouse)
	UNLEADED GASOLINE (a similar material):		
	VAPOR (TE _{Lo}):	Acute	140 ppm (Human) (8 hours) - Mild eye irritant!
	VAPOR (TE _{Lo}):	Acute	500 ppm (Human) (1 hour) - Moderate eye irritant!
	VAPOR (TC _{Lo}):	Acute	900 ppm (Human) (1 hour) - CNS and pulmonary effects
	DERMAL (TD _{Lo}):	Acute	53 mg/kg (Human) - Skin allergy effects
	VAPOR (LC ₅₀):	Acute	101,200 ppm (Rat, Mouse, & Guinea Pig) (5 minutes)

B.T. Reform Feed

In a large epidemiological study on over 15,000 persons, no increased risk of kidney cancer was seen in association with **gasoline** exposures for employees at several petroleum refineries or amongst residents located near these refineries. In another study, no increased risk of kidney cancer was seen amongst petroleum refinery workers, but there was a slight trend in kidney cancers among service station employees, especially after a 30-year latency period.

Two-year inhalation toxicity studies with **fully vaporized unleaded gasoline** (at 67, 292, & 2,056 ppm in air) produced kidney damage and kidney tumors in male rats, but not in female rats or mice of either sex. Female mice developed a slightly higher incidence of liver tumors compared to controls at the highest concentration. Results from subsequent scientific studies suggest that the kidney damage, and probably the kidney tumor response, is unique to the male rat. An EPA draft policy statement takes account of alpha-2u-globulin findings as a basis for discarding male rat kidney data in determining whether gasoline is a carcinogen. In additional rat studies, the *maternal and developmental NOEL was determined to be 9,000 ppm (75% of the LEL value)*. Under conditions of the study, **volatilized unleaded gasoline vapor** did NOT produce evidence of any type of developmental toxicity.

There were no benzene-induced blood toxin or leukemia effects noted in laboratory animals following long-term exposures to **fully-volatilized unleaded gasoline vapor containing 2 vol.% benzene**. However, the relative risk to humans for benzene in gasoline is still unknown.

An **n-butane** exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, **n-pentane** caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.

Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of **isobutane and n-butane** in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of **isobutane** may cause liver and/or kidney damage. Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of **butane and butylenes** (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.

Inhalation of 500 ppm of **isopentane or n-pentane** have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of **n-pentane** for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt % in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both **isopentane and n-pentane** using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.

Intentional abuse of products containing **n-hexane** have been associated with permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially among women. Chronic repeated or prolonged overexposure to n-hexane, either by inhalation or skin absorption, has been associated with peripheral neuropathy in both human workers and rodents. The neurotoxic properties of n-hexane may increase with concurrent exposure to methyl ethyl ketone, methyl isobutyl ketone or toluene. n-Hexane has been associated with testicular degeneration and epididymal lesions in rats. Also, n-hexane produced fetal toxicity and reduced fetal weight in mice at maternally toxic doses.

Other **hexane isomers** can cause eye and skin irritation, but they were not shown to be mutagenic in the Salmonella/microsome (Ames) assay. They are not considered neurotoxic or carcinogenic.

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depression, narcosis, and death at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral routes, there was generalized vascular damage and severe degenerative changes in the heart, lungs, liver, kidneys and brain. Cyclohexane does not act as a promotor for tumors on mice when exposed to dimethylbenzanthracene. Further, it did not induce unscheduled DNA synthesis in cultured human lymphocytes. It is not mutagenic in the Salmonella/microsome (Ames) or the mouse lymphoma L5178Y assays, with or without metabolic activation, however, it did increase the number of chromosomal aberrations in bone marrow cells of rats exposed to between 100 and 300 ppm for 6 hours/day for 5 days. These chromosomal aberrations did not appear to be dose-related.

Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. Prolonged and repeated exposure to high concentrations of benzene is associated with injury to blood forming organs and anemia. Consumption of alcohol may increase the blood system changes related to benzene exposure. It is linked to the development of acute myelogenous leukemia.

B.T. Reform Feed

(AML) in humans NTP, IARC, and OSHA list benzene as carcinogenic to humans. Studies of workers exposed to high levels of benzene have identified humoral and cellular immunity impairment and a decrease in levels of circulating leukocytes. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice. Animal studies have shown testicular effects and alterations in reproductive cycles with some evidence of developmental effects. Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity.

n-Heptane is a skin, mucous membrane, and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by either inhalation or dermal exposure. Overexposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans. One occupational exposure study with **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. Polyneuropathy was reversible within a year following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

Deliberate long-term inhalation of **toluene** at high concentrations (e.g., glue sniffing) has been associated with reversible liver effects, permanent kidney damage, CNS depression, brain damage, and cardiac (heart muscle) sensitization. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency). In addition, intentional abuse behavior increases the risk for reproductive effects including pre-term delivery, prenatal death and growth retardation. Also, case studies of persons abusing toluene have revealed isolated incidences of birth defects. Long-term inhalation studies with toluene produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness and impaired reaction time in laboratory animals. Also, in long-term laboratory studies, rats exposed to high concentrations (1,200 to 1,400 ppm) of toluene exhibited high-frequency hearing loss. Case studies have reported hearing damage in humans exposed elevated concentrations of toluene and other mixed solvents.

Studies have indicated that children of women who sniffed massive exposures of **toluene** during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic, nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

Overexposure to **xylene isomers** may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage, and narcosis. Effects may be increased by the consumption of ethanol (alcoholic beverages) which impairs clearance from adipose (fat) tissues. Also, ototoxicity has been associated with chronic overexposure to xylene. An inhalation study with laboratory rats also indicated an association between elevated mixed xylene exposures and hearing loss. Lung inflammation and liver damage were identified as health effects in chronic studies using guinea pigs.

B.T. Reform Feed

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene (dimethylbenzenes)** showed "no evidence of carcinogenicity" Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays Animal inhalation and feeding studies have also associated embryo and fetotoxicity with maternally toxic dose exposures of mixed xylene isomers and ethylbenzene Fetal toxicity included increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes The significance of these animal study results to humans is not known.

NTP completed a 2-year inhalation bioassay of **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level, and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice The relevance of these findings to human health is unclear However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B)

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. Its TC_{L_50} for humans 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation studies with rats, four of ten animals died after exposures of 2,400 ppm for 24 hours An oral dose of 5 mL/kg resulted in death in one of ten rats Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. **Mesitylene (1,3,5-Trimethylbenzene)** inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity

Indene and ethylmethylbenzenes are primary skin irritants. Overexposure has been associated with kidney damage and increased blood cholinesterase levels In inhalation developmental studies, indene and other **C9 aromatic hydrocarbons** have been associated with decreased fetal and newborn pup weights

Naphthalene is a potential irritant to eyes, skin and lungs Ingestion of naphthalene has been associated with severe red blood cell and liver damage leading to death. Following prolonged or repeated exposures, naphthalene has been shown to cause cataracts, optical neuritis, hemolytic and aplastic anemia, kidney damage (jaundice), and possibly neurotoxicity In animal studies, naphthalene caused fetal effects and decreased spleen weights in pregnant female mice In an NTP sponsored study, naphthalene produced a dose related increase in tumors at the 30 and 60 ppm exposure level in both male and female rats. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas and non-neoplastic lesions of the nose were observed as compared to controls Cytogenic studies with Chinese hamster ovary cells have demonstrated sister chromatid exchanges and chromosomal aberrations The relevance of these studies to human health is unclear

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life This material will normally evaporate rapidly if spilled If released, volatile **aromatic hydrocarbon components (benzene, toluene, xylenes, ethylbenzene, cumene, and trimethylbenzenes)** may contribute to the creation of atmospheric smog. The atmospheric half-lives of the **butanes** under photochemical smog conditions are estimated to be between 5 and 7 days Photooxidation of **isobutane and n-butane** in air (<8%) is not considered to be environmentally significant. **Isopentane, n-pentane, n-hexane, hexane isomers, n-heptane, heptane isomers, and iso-octane** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present

B.T. Reform Feed

Toluene has a half-life of from 3 hours to slightly over 1 day and **cyclohexane** has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present

This material is potentially toxic to freshwater and saltwater ecosystems. Using Rainbow Trout (*Salmo irideus*), various Gasolines showed an LC100 (the Lethal Level) from 40 ppm to 100 ppm in ambient stream water. A 24-hour TLM (Median Toxic Limit) resulted in 90 ppm when using juvenile American Shad (*Squalius cephalus*). Using Bluegill Sunfish (*Lepomis macrochirus*), Grey Mullet (*Chelon labrosus*), and Gulf Menhaden (*Brevoortia patronus*), Gasoline showed a 96-hour LC50 of 8 ppm, 2 ppm, and 2 ppm, respectively.

Environmental Fate

This material is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status This material is regulated by the U.S. Department of Transportation (DOT)

Proper Shipping Name Petroleum distillates, n.o.s. (Hexanes, Heptanes)

Hazard Class DOT Class 3 (Flammable liquid).

Packing Group(s) PG II

UN/NA ID

UN1268

Reportable Quantity The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are **Cyclohexane, Benzene, and/or Xylenes.**

Placards



Emergency Response Guide No. 128

HAZMAT STCC No.

49 102 68

MARPOL III Status

All impacted components were delisted as DOT "Marine Pollutants" per 66 FR 120 (page 33413) dated 6/21/2001

B.T. Reform Feed

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: n-Hexane [CAS No. 110-54-3] concentration: 1 to 15% Cyclohexane [CAS No. 110-82-7] concentration: 1 to 25% Benzene [CAS No. 71-43-2] concentration: 0.1 to 7% Toluene [CAS No. 108-88-3] concentration: 0.5 to 16% Xylenes [CAS No. 1330-20-7] concentration: 1 to 15% Ethylbenzene [CAS No. 100-41-4] concentration: 0.3 to 5% Cumene [CAS No. 92-82-8] concentration: 0 to 2% 1,2,4-Trimethylbenzene (Pseudocumene) [CAS No. 95-63-6] concentration: 0.5 to 1.5% Naphthalene [CAS No. 91-20-3] concentration: 0.1 to 3%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this material which are subject to this statute are: n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 1 to 15% Cyclohexane [CAS No. 110-82-7] (RQ = 1,000 lbs. [453.6 kg]) concentration: 1 to 25% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 7% Toluene [CAS No. 108-88-3] (RQ = 1,000 lbs. [453.6 kg]) concentration: 0.5 to 16% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1,000 lbs. [453.6 kg]) conc.: 0 to 5% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 15% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.3 to 5% Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0 to 2% Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 3%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling, refer to components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act: Because it contains detectable amounts of Cyclohexane [CAS No. 110-82-7] , this product might be subject to US EPA's one-time only per country export notification requirements.

B.T. Reform Feed

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare" **Isopentane [CAS No. 78-78-4], 1-Pentene [CAS No. 109-67-1], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 71-43-2], Methylcyclohexane [CAS No. 108-87-2], Toluene [CAS No. 108-88-3], Xylenes [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], and Cumene [CAS No. 98-82-8].**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Isobutane (Propane, 2-methyl), n-Butane, Isopentane (Butane, 2-methyl), various Pentenes, and n-Pentane**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1 0
Revision Date 01/21/2002
Print Date Printed on 01/21/2002.

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists				AIHA = American Industrial Hygiene Association		
IARC = International Agency for Research on Cancer				NTP = National Toxicology Program		
NIOSH = National Institute of Occupational Safety and Health				OSHA = Occupational Safety and Health Administration		
NPCA = National Paint and Coating Manufacturers Association				HMIS = Hazardous Materials Information System		
NFPA = National Fire Protection Association				EPA = Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



BTU C8 Splitter Overhead

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0167
Revision Date 10/2/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent, colorless. Odor Light hydrocarbons.

DANGER! Extremely flammable liquid;
vapor may cause flash fire or explosion.
May be harmful or fatal if inhaled, ingested or absorbed
through the skin.
Liquid contact may cause mild to severe skin irritation,
inflammation, and/or blistering.
Mist or vapor may irritate the mucous membranes and
respiratory tract.
Aspiration into the lungs will cause pulmonary edema
and chemical pneumonia.
Overexposures may cause central nervous system (CNS)
depression and target organ effects such as auditory
and/or peripheral nerve, liver, and/or kidney damage.
Prolonged and/or repeated inhalation may increase the heart's
susceptibility to arrhythmias (irregular beats).
Potential cancer hazard. Contains Benzene!
May cause leukemia and/or other blood disorders.
Mutagenic hazard; may cause genetic damage!
May adversely affect reproduction or reproductive development.
Spills may create a slipping hazard.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	BTU C8 Splitter Overhead	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110167	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	68956-52-5 or 64741-63-5	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	C4-C8 Petroleum Hydrocarbons		
Synonyms	Benzene-Toluene Unit C8 Splitter Tower Overhead; 732 Unit C8 Splitter Overhead; BTU Light Reformate; Light Reformer Splitter Naphtha; BTU Extractor Tower Feed; Light Naphtha; C4-C8 Solvent; BT Solvent.		

BTU C8 Splitter Overhead

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) C4-C8 Hydrocarbons	68956-52-5	100
2) Light Catalytic Reformed Naphtha (Petroleum)	64741-63-5	100
3) Butanes	Mixture	0.5-2
4) Pentanes	Mixture	1-10
5) Hexane Isomers	Mixture	10-25
6) n-Hexane	110-54-3	1-5
7) Benzene	71-43-2	5-20
8) Heptanes	Mixture	10-25
9) Methylcyclohexane	108-87-2	1-5
10) Toluene	108-88-3	25-40
11) Octanes	Mixture	1-10
12) Ethylbenzene	100-41-4	0.1-0.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin Contact. Eye Contact. Skin Absorption.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this product can cause mild to severe eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Tests on this material's components suggest that mild to severe skin irritation, inflammation, and blistering is expected to occur upon short-term liquid contact. Certain components of this material, including n-hexane, cyclohexane, benzene, n-heptane, toluene, and iso-octane may be absorbed through the skin, and produce toxic effects such as CNS depression (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline/naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this product may be harmful or fatal.

Chronic inhalation to components of this light naphtha (**n-butane, n-pentane, n-heptane, and toluene**) may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of epinephrine

BTU C8 Splitter Overhead

(adrenaline)-like drugs.

Even with acute exposures, **n-hexane** is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, n-hexane's metabolite, **2,5-hexanedione**, has been shown to cause degeneration of the testes.

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Chronic occupational **toluene and xylene** exposures have caused auditory nerve degeneration.

At high exposure concentrations, **ethylbenzene** has been associated with multiple organ tumors in laboratory animals.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylene isomers and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period.

Conditions Aggravated by Exposure

Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, or chronic respiratory diseases, and women attempting to conceive should avoid exposure.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

This material is toxic to lungs, nervous systems, especially the auditory and peripheral nerves, brain, blood, kidneys, liver, heart, thymus, mucous membranes, skin, eyes, and possibly the reproductive systems.

Carcinogenic Potential

This material contains benzene and ethylbenzene at concentrations above at or above 0.1%. **Benzene** is considered to be a known human carcinogen by OSHA, IARC and NTP and **Ethylbenzene** is considered possibly carcinogenic to humans by IARC. (See Section 11.)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

BTU C8 Splitter Overhead

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If contacted by liquid, check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment unless directed to by a physician. If pain, redness, swelling, or tearing, persist, obtain medical attention as soon as possible.
Skin Contact	The affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. Then remove contaminated shoes and clothing. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended. This material may also make the heart more susceptible to arrhythmias (irregular beats). Catecholamines and other sympathomimetic drugs such as epinephrine (adrenline) should be reserved for emergency situations and then used only with special precaution.</p> <p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress, arterial blood gases, and chest x-ray in cases with significant exposure. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Continue monitoring for cardiac function, respiratory distress, and arterial blood gases in severe exposure cases.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid. Extremely flammable!		
Flash Point Method	CLOSED CUP: -45° to -42°C (-50° to -45°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.4 %	Upper Flammable Limit	AP 8.3 %
Autoignition Temperature	AP 232°C (450°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly sulfur oxides and/or unburned mercaptans.		
Special Properties	Extremely Flammable Light Naphtha! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		

BTU C8 Splitter Overhead

Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers or waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable Light Naphtha! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Establish a "regulated zone" with site control and security. Remove all potential ignition sources. If possible, allow this material to evaporate. Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. If possible, turn leaking containers so that gas escapes rather than liquid. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Do not touch, walk through spilled material, or enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. A vapor-suppressing foam may also be used to reduce vapors.

Caution: Many materials become brittle and are likely to break without warning when they contact this cryogenic gas/liquid. Stop the leak if it can be done without risk. Safely stop the source gas flow using non-sparking tools. All equipment used when handling this material must be grounded. Prevent its entry into waterways, sewers, basements, or confined areas, especially where there is danger of its vapors being ignited by a remote ignition source. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Remove spillage immediately from hard, smooth walking areas.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/2 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This material should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases/spills may need to be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling	Odor is an inadequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Do not allow vaporizing material to contact eyes, skin, or other tissues. Never siphon by mouth. Prevent contact with food, chewing, or smoking materials. Do not take internally.
	Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment as necessary to remove material residues.

BTU C8 Splitter Overhead

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits and wear personal protective clothing as shown in Section 8. Promptly remove contaminated clothing. Wash exposed skin thoroughly with mild soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store other toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and well sealed. All label warnings and precautions must be observed. Return empty containers to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable material should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposures, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gas/liquid mixtures. If this material is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Suitable eye wash water should be readily available.

Hand Protection

Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves (e.g. disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) to protect hands from potential contact with cold liquid or vapors. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

BTU C8 Splitter Overhead

Body Protection	Prevent potential skin contact with cold liquid or vapors. Wear insulated and chemical-resistant clothing (e.g. Tyvek®, nitrile, or neoprene) over fire-retardant garments (e.g. Nomex®) while working with flammable gas/liquid mixtures. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
Respiratory Protection	Use a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Air purifying respirators offer no protection against oxygen deficient atmospheres. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of this light naphtha may create flammable, explosive, and/or oxygen-deficient atmospheres (< 19.5 Vol.% in air). DO NOT ENTER such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Gasoline ("A3 Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) TWA: 300 STEL: 500 (ppm) from OSHA (PEL) [Proposed]
2) Petroleum Distillates (Naphtha)	TWA: 500 (ppm) from OSHA (PEL)
3) Butanes	TWA: 800 (ppm) from ACGIH (TLV) TWA: 800 (ppm) from OSHA (PEL) [Proposed]
4) Pentane, all isomers	TWA: 600 (ppm) from ACGIH (TLV) TWA: 600 STEL: 750 (ppm) from OSHA (PEL) [Proposed] TWA: 1000 (ppm) from OSHA (PEL)
5) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [Proposed]
6) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 50 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
7) Benzene ("A1" and "Z-2" Known Human Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) - SKIN TWA: 1 STEL: 5 (ppm) from OSHA (PEL) - SKIN
8) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
9) Methylcyclohexane	TWA: 400 (ppm) from ACGIH (TLV) TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [Proposed]
10) Toluene	TWA: 50 (ppm) from ACGIH (TLV) - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [Proposed] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL)
11) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [Proposed] TWA: 500 (ppm) from OSHA (PEL)
12) Ethylbenzene ("A3" Animal Carcinogen)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [Proposed] TWA: 100 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color Transparent, colorless.	Odor	Light hydrocarbons.
Specific Gravity	0.73 to 0.77 (Water = 1)	pH Not applicable.	Vapor Density	2.9 to 3.2 (Air = 1)
Boiling Point/Range	-12° to 141°C (10° to 285°F) at 14.7 psia [ASTM D-2887]		Melting/Freezing Point	-160° to 5°C (-256° to 42°F) at 14.7 psia
Vapor Pressure	AP 6 to 20 psia at 40°C (104°F)		Viscosity (cSt @ 40°C)	< 0.5 to 1.0
Solubility in Water	Slightly soluble in cold water (< 0.1%).		Volatile Characteristics	Volatile Organic Compounds (VOCs) Content = 100%; AP 700 gm/L.

BTU C8 Splitter Overhead

Additional Properties Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 34 to 70 Wt.% [ASTM D-1319];
 C6-C8 Aromatic Hydrocarbon Content = 30 to 66 Wt.% [ASTM D-1319];
 Average Density at 60°F = 6.244 lbs./gallon [ASTM D-2161];
 Dry Point Temperature = 282°F (139°C) [ASTM D-86];
 Evaporation Rate = 4.5 to 6.5 when n-Butyl acetate = 1.0.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, fluorine and fluoride compounds, bromine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions. This material may dissolve some plastics.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data	<p>An n-butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Butane is also thought to decrease the myocardial threshold to epinephrine-induced arrhythmias. And, n-pentane caused cardiac sensitization in rabbits at a 100,000 ppm concentration in air within 4 hours of exposure.</p> <p>Human volunteers had no apparent effects from exposure concentrations of 250 ppm, 500 ppm, and 1,000 ppm of isobutane and n-butane in air for periods of 8 hours daily for 10 days to 14 days, respectively. However, chronic inhalation of high concentrations of isobutane may cause liver and/or kidney damage.</p> <p>Laboratory animals have exhibited a higher degree of narcosis when exposed to the combination of butane and butylenes (additive effect), than the degree of narcosis exhibited following exposure to any one gas alone.</p> <p>Inhalation of 500 ppm of isopentane or n-pentane have been reported NOT to produce any ill effects in humans. Additionally, the inhalation of 5,000 ppm of n-pentane for 10 minutes has been reported NOT to produce any ill effects; however, higher exposure concentrations of 90,000 to 120,000 ppm (9-12 Wt.% in air) have caused central nervous system depression and narcosis. Approximately 130,000 ppm can be fatal. Rat 28-day feeding studies done on both isopentane and n-pentane using a 10,000 mg/kg dosage produced test animal weight loss or decreased weight gain, especially in their bladders, and some deaths.</p> <p>Intentional sniffing abuse of n-hexane has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to n-hexane, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (polyneuropathy). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane may be increased by concurrent exposure to methyl ethyl ketone, methyl isobutyl ketone, and/or toluene.</p> <p>Hexane isomers were not mutagenic in the Salmonella/microsome (Ames) assay and are NOT considered to be carcinogenic. n-Hexane is NOT a tumor promotor in mice and NOT considered to be carcinogenic; nor is it teratogenic in mice or rats. n-Hexane, or its metabolite 2,5-hexanedione, has been shown to cause degeneration of the testes in rats; but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days.</p> <p>Benzene has an IDLH (immediately dangerous to life or health) concentration of 500 ppm. Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes. If ingested, benzene's lethal dose for a normal</p>
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BTU C8 Splitter Overhead

human adult is one teaspoon to one ounce (~10 mL). Studies with pregnant laboratory animals have demonstrated that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with in chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children/teenagers have less resistance.

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is readily absorbed by inhalation and dermal exposure and repeated direct skin application can produce defatting dermatitis. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. n-Heptane is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with n-heptane exposure was reversible within a year following removal of exposure.

Rats inhaling **methylcyclohexane** at an airborne concentration of 15,250 ppm for 1 hour displayed tremors, loss of coordination, anesthesia, and convulsions. Inhalation of 10,050 ppm for 6 hours per day for 14 days showed rodent weight loss or decreased weight gain and changes in the structure of their salivary glands. Using rabbits, methylcyclohexane was shown to have an LD50 somewhere between 3,300 ppm and 7,300 ppm when exposed repeatedly for 6 hours per day, 5 days per week, for 3 weeks. Death was preceded by conjunctival congestion with mucoid secretion and lacrimation, salivation, coughing, sneezing, labored breathing, and diarrhea. Lethal oral dosing of rabbits caused lethargy, severe diarrhea, and circulatory collapse. Vascular and degenerative lesions were observed in the kidneys and liver.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (< 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed

BTU C8 Splitter Overhead

massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic; nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

2,2,4-Trimethylpentane (Iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity". And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

NTP completed a 2-year inhalation bioassay of **ethylbenzene** in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. If spilled, the naphtha portion of this material, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Using Rainbow Trout (<i>Oncorhynchus mykiss</i>) and Dungeness Crab (<i>Cancer magister</i>), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. 24-hour TLms resulted in 2,990 ppm and 250 ppm when using Bluegill Sunfish (<i>Lepomis macrochirus</i>) and juvenile American Shad (<i>Squalius cephalus</i>), respectively. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.
Environmental Fate	This material will normally evaporate rapidly if spilled. Releases are expected to cause environmental damage. At ambient temperatures and pressure, the volatile aromatic hydrocarbon components (benzene and toluene) of this material may contribute to the creation of atmospheric smog. The atmospheric half-lives of the butanes under photochemical smog conditions are estimated to be between 5 and 7 days. Photooxidation of isobutane and n-butane in air (< 8%) is not considered to be environmentally significant. The pentanes, n-hexane, n-heptane, hexane and heptane isomers, and iso-octane all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present. Benzene and toluene have half-lives of less than 3 hours

BTU C8 Splitter Overhead

to slightly over 1 day and **Cyclohexane** has a half-life of from 6 hours to over 4 days when hydroxyl radicals are present.

This material is potentially toxic to freshwater and saltwater ecosystems. Its heavier components will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Toluene, Heptanes and/or Hexanes)		
Hazard Class	DOT Class: 3 (Flammable liquid).	Packing Group(s)	PG I
		UN/NA ID	UN1256
Reportable Quantity	The Reportable Quantity (RQ) substance components present in this material which might require DOT HAZMAT bill-of-lading display are Toluene and Benzene .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

BTU C8 Splitter Overhead

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material does not contain any chemical substances subject to this statute.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard and Acute (Immediate) and Chronic (Delayed) Health Hazards.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as a "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313: n-Hexane [CAS No. 110-54-3] concentration: 1 to 5% Benzene [CAS No. 71-43-2] concentration: 5 to 20% Toluene [CAS No. 108-88-3] concentration: 25 to 40% Ethylbenzene [CAS No. 100-41-4] concentration: 0.01 to 0.5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances that might be present in this material which are subject to this statute are: n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 1 to 5% Cyclohexane [CAS No. 110-82-7] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.1 to 0.5% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 5 to 20% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 25 to 40% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 0.1 to 2.5% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 0.9% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0.01 to 0.5%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it may be subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of the Toxic Substances Control Act: Because it contains detectable amounts of Cyclohexane (CAS No. 110-82-7) , this material might be subject to US EPA's one-time only per country export notification requirements. In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": Isopentane [CAS No. 78-78-4], 1-Pentene [CAS No. 109-67-1], n-Pentane [CAS No. 109-66-0], Cyclohexane [CAS No. 110-82-7], Benzene [CAS No. 71-43-2], Methylcyclohexane [CAS No. 108-87-2], Toluene [CAS No. 108-88-3], Xylenes [CAS No. 1330-20-7], and Ethylbenzene [CAS No. 100-41-4].

BTU C8 Splitter Overhead

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. Substances present in this material which are subject to this statute are: **Isobutane (Propane, 2-methyl) [CAS No. 75-28-5]**, various **Butenes [CAS No. 25167-67-3]**, **n-Butane [CAS No. 106-97-8]**, **Isopentane (Butane, 2-methyl) [CAS No. 78-78-4]**, various **Pentenenes [CAS No. 68527-11-7]**, and **n-Pentane [CAS No. 109-66-0]**.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 10/2/2002
Print Date Printed on 10/2/2002.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists	AIHA: American Industrial Hygiene Association					
IARC: International Agency for Research on Cancer	NTP: National Toxicology Program					
NIOSH: National Institute of Occupational Safety and Health	OSHA: Occupational Safety and Health Administration					
NPCA: National Paint and Coating Manufacturers Association	HMIS: Hazardous Materials Information System					
NFPA: National Fire Protection Association	EPA: US Environmental Protection Agency					

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



Kerosine, Straight-run (C9-C16 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0206
Revision Date 09/05/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent, colorless **Odor** Characteristic, kerosene-like.
to water-white.

WARNING! Combustible liquid; vapor may cause flash fire!
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!

Liquid contact may cause minimal to mild eye and/or moderate to severe skin irritation and inflammation!

Based upon laboratory animal studies, may cause skin cancer following extended contact!

May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects!

May be harmful or fatal if ingested!
Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia!

Based upon animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	0
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Kerosine, Straight-run (C9-C16 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	008008206*	Medical Emergency	(918) 495-4700
CAS Number	8008-20-6	CHEMTREC Emergency	(800) 424-9300
Product Family	Petroleum Hydrocarbon Middle Distillate		
Synonyms	Straight-run Kerosine, Unrefined, Untreated, or Raw Kerosine or Kerosene, Water White Distillate from a Petroleum Crude Still; Crude Tower Light Distillate; Straight-run Light Middle Distillate, High-Sulfur No. 1 Fuel; Untreated No. 1 Fuel Oil; Unrefined 2-K Kerosene; Unfinished Jet Fuel, Stove Oil, Lamp Oil, or Range Oil; C9-C16 Petroleum Hydrocarbons		

Kerosine, Straight-run (C9-C16 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Kerosine (Petroleum)	8008-20-6	100
2) Nonanes	Mixture	10-20
3) Trimethylbenzene (mixed isomers)	25551-13-7	0.5-1.5
4) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-3
5) C10 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	15-50
6) Naphthalene	91-20-3	1-3
7) C10-C11 Alkylbenzenes	70693-06-0	1-10
8) C11 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	10-20
9) C12 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	5-15
10) Biphenyl (Diphenyl)	92-52-4	0.5-1.5
11) C13-C16 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	5-20

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this product can cause minimal to mild eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials suggest that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. People chronically exposed to jet fuel (similar to straight-run kerosine) at an average concentration of 250 mg/m ³ (~ 85 ppm) in air for 4 to 32 years showed higher incidence of neuropsychiatric symptoms than unexposed persons. Symptoms included anxiety, sleep disturbances, irritability, attention deficits, memory impairment, depression, fatigue, mood and personality changes, and neurasthenic syndrome. Also, reports have associated repeated and prolonged occupational overexposure to similar solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). This straight-run kerosine is a middle distillate similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced.

Kerosine, Straight-run (C9-C16 Hydrocarbons)

Based upon animal testing, the **C9 aromatic hydrocarbon components (trimethylbenzenes and ethylmethylbenzenes)** are presumed to cause fetal toxicity and/or decreased fetal and newborn weights if overexposure occurs during a woman's early gestation period

Naphthalene, a component of this product, is considered to be a toxic substance as defined by both human exposure and laboratory testing results.

Biphenyl (Diphenyl) may cause liver and/or nerve damage. (See Section 11.)

Conditions Aggravated by Exposure	Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases, and women attempting to conceive should avoid exposure.
Target Organs	This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the blood, liver, kidneys, and reproductive system.
Carcinogenic Potential	This material contains middle distillates at above 0.1% and it is considered carcinogenic by IARC and OSHA. (See Section 11)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to **Exposure Controls and Personal Protection** in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Kerosine, Straight-run (C9-C16 Hydrocarbons)

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-II Combustible Liquid. Highly combustible!		
Flash Point/Method	CLOSED CUP 49° to 57°C (120° to 135°F). (Tagliabue (ASTM D-56))		
Lower Flammable Limit	AP 0.7 %	Upper Flammable Limit	AP 5.0 %
Auto-Ignition Temp.	AP 210°C (410°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	<p>Combustible Liquid! This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.</p>		
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>		
Fire Fighting Protective Clothing	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.</p>		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

Kerosine, Straight-run (C9-C16 Hydrocarbons)

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

Kerosine, Straight-run (C9-C16 Hydrocarbons)

General Comments

Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)	TWA: 100 (mg/m ³) from ACGIH (TLV) [Proposed for 2000] - SKIN
2) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) [1999] TWA: 200 (ppm) from OSHA (PEL) [1989]
3) Trimethylbenzene (mixed isomers)	TWA: 25 (ppm) from ACGIH (TLV) [1999] TWA: 25 (ppm) from OSHA (PEL) [1989]
4) Naphthalene ("A4" = Not Classifiable")	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [1989] TWA: 10 (ppm) from OSHA (PEL) [1976]
5) Biphenyl (Diphenyl)	TWA: 0.2 (ppm) from ACGIH (TLV) [1999] TWA: 0.2 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, colorless to water-white.	Odor	Characteristic, kerosene-like.
Specific Gravity	0.81 to 0.84 at 60°F (Water = 1)	pH	Not applicable	Vapor Density	5.0 to 5.2 (Air = 1 at 70°F)
Boiling Point/Range	155° to 300°C (310° to 572°F) (ASTM D-2887)	Melting/Freezing Point			LT -25°C (-13° F) (ASTM D-2386)
Vapor Pressure	1.6 to 1.8 mm Hg at 20°C (68°F)	Viscosity (cSt @ 40°C)			2 to 4 (ASTM D-445) and LT 8 cSt at -20°C.
Solubility in Water	Negligible to slightly soluble in cold water (AP 0.005 to 0.04%).	Volatile Characteristics			Volatile Organic Compounds (VOCs) Content = 100%; AP 825 gm/L.
Additional Properties	Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 80 to 90 Wt.% (ASTM D-1319); C8-C15 Aromatic Hydrocarbon Content = 10 to 20 Wt.% (ASTM D-1319); Average Density at 60°F = 6.869 lbs./gal (ASTM D-2161); Cetane Number GT 40 (ASTM D-613 or D-976); Saybolt Viscosity = 32.5 to 39 SUS at 100°F (ASTM D-2161); Sulfur Content = LT 0.3 Wt %) (ASTM D-2622, D-1266, or D-1552), Ash Content = 0.1 to 0.01 Wt % (ASTM D-482); 90% Boiling Point Temperature = LT 500°F (260°C) (ASTM D-86), Dry Point Temperature = 565°F (296°C) (ASTM D-86), Evaporation Rate = AP 0.04 when n-Butyl acetate = 1.0; Net Heat of Combustion Value = GT 18,400 Btu/lb. (ASTM D-1405 or D-2382).				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

**Kerosine, Straight-run
(C9-C16 Hydrocarbons)**

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Kerosine (Petroleum)

ORAL (LD50): Acute GT 5,000 mg/kg [Rat screen] - Diarrhea, hypoactivity, and somnolence.
 ORAL (LD50) Acute. 2,835 mg/kg [Rabbit] - Respiratory stimulation and muscle weakness.
 ORAL (LD50): Acute 20 mg/kg [Guinea Pig] - Respiratory stimulation and muscle weakness.
 INTRAVENOUS (LD50): Acute 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma.
 INTRATRACHEAL (LD50): Acute 800 mg/kg [Rat] - Convulsions, dyspnea, and cyanosis.
 INTRATRACHEAL (LD50) Acute 200 mg/kg [Rabbit] - Convulsions and cyanosis.
 INTRAPERITONEAL (LD50) Acute: 6,600 mg/kg [Rabbit] - Pulmonary edema, emphysema, and changes to the bronchi.

Hydrodesulfurized Kerosine (similar to Straight-run Kerosine).

ORAL (LD50): Acute: GT 5,000 mg/kg [Rat screen] - Excess salivation, diarrhea, hair loss, hypoactivity, and somnolence.
 GAS (LC50): Acute: GT 5,200 mg/L for 4 hours [Rat screen]] - Dyspnea.
 DERMAL (LD50): Acute: GT 2,000 mg/kg [Rabbit screen].

n-Nonane:

GAS (LC50): Acute: 3,200 ppm for 4 hours [Rat].
 INTRAVENOUS (LD50): Acute: 218 mg/kg [Mouse]

Trimethylbenzenes:

ORAL (LD50) Acute: 8,970 mg/kg [Rat]

Ethylmethylbenzenes (Ethyltoluenes):

GAS (LC50) Acute: 50,000 mg/m³ for 2 hours [Cat].
 GAS (LC50) Acute: 54,000 mg/m³ for 4 hours [Mouse].

Naphthalene:

ORAL (LD50): Acute 490 mg/kg [Rat].
 ORAL (LD50): Acute: 533 mg/kg [Mouse]
 ORAL (LD50): Acute: 1,200 mg/kg [Guinea Pig].
 SUBCUTANEOUS (LD50): Acute: 969 mg/kg [Mouse].
 INTRAVENOUS (LD50): Acute: 100 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 150 mg/kg [Mouse].

Biphenyl (Diphenyl or 1,1'-Biphenyl):

GAS (TCLo): Acute 4,400 ug/m³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting
 ORAL (LD50). Acute GT 2,600 mg/kg [Cat screen]
 ORAL (LD50): Acute 2,400 mg/kg [Rat and Rabbit]
 ORAL (LD50). Acute: 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea
 DERMAL (LD50): Acute: GT 5,010 mg/kg [Rabbit screen].
 INTRAVENOUS (LD50): Acute 56 mg/kg [Mouse].

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 650°F., commonly referred to as "middle distillates, including kerosine" have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Kerosine has not been identified as a carcinogen by IARC, NTP, or OSHA. These similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Untreated (straight-run) kerosine produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, and the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) assay; however, the in-vivo mouse SCE assay and in-vitro S9-activated CHO SCE assay produced positive responses. The significance of these animal study results to human health is unclear.

Rats inhaling n-nonane at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given n-nonane for 2 to 7 days

Trimethylbenzenes are primary skin irritants and may cause asthmatic bronchitis and/or anemia. Based upon animal reproductive/developmental studies, trimethylbenzenes may also cause fetal toxicity

Kerosine, Straight-run (C9-C16 Hydrocarbons)

Ethylmethylbenzenes are primary skin irritants and overexposures might cause liver and/or kidney damage or increase blood cholinesterase levels. Inhalation of these and other **C9 aromatic hydrocarbons** by pregnant mice and rats during gestational days 6 through 15 resulted in decreased fetal and newborn weights.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction of red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in 8 of 21 workers exposed to elevated levels of naphthalene vapors for 5 years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Also, naphthalene may cause fetal toxicity or damage. Laboratory studies produced limited evidence of fetal toxicity in pregnant female mice including decreased spleen weights.

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage. Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this kerosene, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, volatile aromatic hydrocarbon components (**trimethylbenzenes, ethylmethylbenzenes, and naphthalene**) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalus cephalus*), similar kerosenes and some of this material's components showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 20 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Based upon actual spill incident investigations, similar naphtha and kerosene mixtures have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This kerosene is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U S National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Kerosine, Straight-run (C9-C16 Hydrocarbons)

Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status This material is regulated by the U.S. Department of Transportation (DOT)

Proper Shipping Name Kerosene

This material has a flash point temperature of between 100° and 141°F (38° to 60°C). For bulk shipments, it is classified as a DOT "Flammable Liquid". However, according to 49 CFR 173.120(b)(2) and 173.150(f)(1), this material may be reclassified as a "Combustible Liquid" and exempted from certain transportation-related requirements, such as labeling, when shipped in non-bulk "limited-quantity" containers of less than 119 gallons capacity. According to 49 CFR 173.150(f)(2) and (3), this provision does not apply to "limited-quantities" offered for or transported via vessel or aircraft or products which are defined as DOT "Marine Pollutants". It is recommended that "Flammable Liquid" products which are reclassified be so identified on the bill-of-lading as "Combustible liquid, n.o.s. (Kerosene) or (Nonanes, Trimethylbenzenes)" with identification number "NA1993".

Hazard Class Class 3 Flammable liquid. **Packing Group(s)** PG III
UN/NA ID UN1223 or NA1993

Reportable Quantity The Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are **Naphthalene and Xylenes**.

Placards  **Emergency Response Guide No.** 128
HAZMAT STCC No. 49 122 71
MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory

SARA 302/304 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

SARA 311/312 The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.

SARA 313 This material contains the following components in concentrations which might be at or above de minimis levels and they are listed as a toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313

Naphthalene [CAS No. 91-20-3] concentration: 1 to 3%

Biphenyl (Diphenyl) [CAS No. 92-52-4] concentration: 0.5 to 1.5%.

CERCLA The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are.

Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 0.1 to 0.9%

Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 0.25%

Cumene [CAS No. 98-82-8] (RQ = 5000 lbs. [2270 kg]) concentration: 0 to 0.5%

Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 3%.

**Kerosine, Straight-run
(C9-C16 Hydrocarbons)**

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

**California
Proposition 65**

This material does not contain any chemical substances which is known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.

**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2

**Additional Regulatory
Remarks**

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13) This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following:
Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!

Under Section 12(b) of TSCA: Because it contains detectable amounts of **C9 Aromatic Hydrocarbons**, this material might be subject to US EPA's one-time only per country export notification requirements.

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Xylenes (mixed) [CAS No. 1330-20-7], Ethylbenzene [CAS No. 100-41-4], Cumene [CAS No. 98-82-8], and Biphenyl (Diphenyl) [CAS No. 92-52-4].**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3 0
Revision Date 09/05/1999
Print Date Printed on 02/17/2000

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Vacuum Tower Condensate (C11-C25 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0208
Revision Date 09/13/2000

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid
Color Transparent to opaque, slightly pale to yellow
Odor Pungent, characteristic, heating oil-like

WARNING! Vapors and fumes may be hazardous or fatal!
Hot vapor (125° to 200°F) might contain hydrogen sulfide, a flammable, toxic, sensitizing, and potentially deadly gas!
When heated, may cause thermal burns on contact!
Mist or vapor may severely irritate the eyes, mucous membranes, and respiratory tract!
Liquid contact may cause minimal eye irritation and/or mild to severe skin irritation and inflammation!
May contain a low level of 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs)! Based upon laboratory animal studies, may cause skin cancer following extended contact!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects!
May be harmful or fatal if ingested! Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia!
Spills may create a slipping hazard!
If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects!
Long-term exposure to fuel exhaust particulates may cause cancer!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Vacuum Tower Condensate (C11-C25 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	064741497*	Medical Emergency	(918) 495-4700
CAS Number	64741-49-7	CHEMTREC Emergency	(800) 424-9300
Product Family	Petroleum Hydrocarbon Intermediate Distillate		
Synonyms	Vacuum Tower Condensate (Petroleum), Vacuum Tower Overhead, VTO, Vacuum Tower Light Distillate; Lightest Component of Vacuum Distillation; 536 and 537 Vacuum Unit Overheads, C11-C25 Petroleum Hydrocarbons		

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Vacuum Tower Condensate (Petroleum)	64741-43-1	100
2) C11 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	1-10
3) C11 Alkylbenzenes	Mixture	1-5
4) Biphenyl (Diphenyl)	92-52-4	0.5-2
5) C12 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	5-15
6) C12-C23 Aromatic Hydrocarbons	Mixture	10-30
7) C13-C25 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	38-82
8) Polynuclear Aromatic Hydrocarbons (4- to 6-member condensed-ring type)	68487-58-6	0.1-1.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled ¹ . Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. Concentrations of H ₂ S at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. H ₂ S concentrations between 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, and/or low blood pressure. At greater than 500 ppm, H ₂ S causes sudden collapse, unconsciousness, and respiratory paralysis leading to convulsions, coma, and/or death. (See Section 11.)
Eye Contact	Upon direct contact, hot material may cause severe thermal burns. Animal test results on similar unheated materials suggest that this product may cause minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness. H ₂ S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).
Skin Contact	Skin contact with hot material may result in severe thermal burns. Animal test results on similar materials suggest that this product can cause mild to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	Contact with hot material may cause thermal burns. If swallowed, this material may irritate the mucous membranes of the mouth, throat, esophagus, and stomach. It can be readily absorbed by the stomach and intestinal tract. Ingestion can produce a burning sensation of the mouth and esophagus and central nervous system depression. Symptoms of CNS depression may include nausea, vomiting, dizziness, staggering gait, drowsiness, shallow rapid pulse, diarrhea, restlessness, sedation, inadequate respiratory function, and heart irregularities. Higher doses may cause loss of consciousness and delirium prior to the onset of convulsions, coma, and death (see "Inhalation" above). A lethal dose may be as low as one-half ounce for a child and one ounce for an adult human.

Due to its low viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration of a small amount of liquid can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

This material is a **middle distillate** similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced.

Biphenyl (Diphenyl) may cause liver and/or nerve damage.

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

Subchronic exposure to low levels of **hydrogen sulfide** can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures (See Section 11.)

Conditions Aggravated by Exposure Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases should avoid exposure

Target Organs This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the liver and kidneys

Carcinogenic Potential This **vacuum tower condensate** is an **intermediate distillate** and contains certain **polynuclear aromatic hydrocarbons** at above 0.1%. It is considered carcinogenic by IARC and OSHA. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If hot vapor gets into the eyes, irrigate with large amounts of room-temperature water. Seek medical attention immediately. If ambient temperature material is splashed into eyes, check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	If burned by hot material, cool skin by quenching with large amounts of cool water. Do not remove material from the skin. Seek medical attention immediately. For contact at ambient temperatures, remove contaminated shoes and clothing. Wipe off excess material. Wash exposed skin with soap and water. If tissue appears damaged or if irritation or pain persists, apply a clean dressing and seek medical attention. Do not use ointments. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. If only cough or difficulty in breathing develop, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis using pulmonary function tests and chest x-rays. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-III B Combustible Material Slightly combustible ¹		
Flash Point Method	CLOSED CUP 95° to 121°C (203° to 250°F) (Pensky-Martens Closed Cup [ASTM D-93])		
Lower Flammable Limit	AP 0.6% to 4%	Upper Flammable Limit	AP 5.8% to 44%
Autoignition Temperature	AP 262°C (505°F)		
Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur		
Special Properties	<p>This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.</p>		
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>		
Fire Fighting Protective Clothing	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.</p>		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material should be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak may cause a potential fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

Hydrogen sulfide vapors might be emitted during production. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR) Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners

Body Protection

Avoid contact It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided Protection factors vary depending upon the type of respirator used Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2)

General Comments

WARNING! Do not use this material as a fuel without adequate ventilation Inadequate ventilation can result in hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is not adequate to warn of hazardous conditions

The standards for "coal tar pitch volatiles, as benzene solubles" are based upon coal coking, not upon petroleum-derived oils However, in 29 CFR 1910.1200.1002, OSHA has defined "coal tar pitch volatiles" to include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood and other organic matter Accordingly, the coal tar pitch volatile standard may apply to the aerosol form of this material The "hydrogen sulfide" standards apply only to generated vapors

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)	TWA: 100 (mg/M ³) from ACGIH (TLV) [Proposed for 2001] - SKIN
2) Biphenyl (Diphenyl)	TWA 0.2 (ppm) from ACGIH (TLV) [2000] TWA 0.2 (ppm) from OSHA (PEL) [1989]
3) Oil mist, mineral	TWA: 5 STEL 10 (mg/M ³) from ACGIH (TLV) [2000] TWA: 5 (mg/M ³) from OSHA (PEL) [1976]
4) Hydrogen sulfide	TWA 10 STEL 15 (ppm) from ACGIH (TLV) [2000] TWA 5 (ppm) from ACGIH (TLV) [Proposed for 2001] TWA 10 STEL 15 CEIL 20 (ppm) from OSHA (PEL) [1989]
5) Coal tar pitch volatiles, as benzene solubles ("A1" Confirmed Human Carcinogen)	TWA 0.2 (mg/M ³) from ACGIH (TLV) [2000] TWA: 0.2 (mg/M ³) from OSHA (PEL) [1989]
6) Oil mist, mineral, sum total of 15 PAHs listed as carcinogens by US NTP	TWA 0.005 (mg/M ³) from ACGIH (TLV) [Proposed for 2001]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Transparent to opaque, slightly pale to yellow	Odor	Pungent, characteristic, heating oil-like
Specific Gravity	0.88 to 0.89 at 60°F (Water = 1)	pH	Not applicable	Vapor Density	5.5 to 10.0 (Air = 1 at 70°F)
Boiling Point/Range	205° to 400°C (401° to 752°F) (ASTM D-86)	Melting/Freezing Point			1° to 7°C (34° to 45°F) (ASTM D-97)
Vapor Pressure	0.1 to 0.4 Reid-psia at 38°C (100°F)	Viscosity (cSt @ 40°C)			7.35 to 11.75 (ASTM D-445)
Solubility in Water	Negligible to slightly soluble in cold water (0.001 to 0.02%).	Volatile Characteristics			Slight; no Volatile Organic Compounds (VOCs) present at 400°F (204°C).
Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 63 to 88.5 Wt % (ASTM D-1319); C11-C25 Aromatic Hydrocarbon Content = 11.5 to 37 Wt % (ASTM D-1319), Average Density at 60°F = 7.369 lbs./gal (ASTM D-2161), Cetane Number = GT 32 (ASTM D-613 or D-976), Saybolt Viscosity = 40 to 55 SUS at 100°F (ASTM D-2161); Sulfur Content = LT 0.5 Wt % (by ASTM D-2622); 90% Boiling Point Temperature = 734° to 745°F (390° to 396°C) (ASTM D-86), Evaporation Rate = LT 0.01 when n-Butyl acetate = 1.0				

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	Composition suggests that sulfur compounds might be generated, but, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Straight-run Middle Distillate and Light Paraffinic Distillate (Petroleum) [similar materials]:

GAS (LC50) Acute: 1.72 to 1.82 mg/L for 4 hours [Rat]
 ORAL (LD50): Acute: GT 5,000 mg/kg [Rat screen] - Diarrhea, hypoactivity, and somnolence
 DERMAL (LD50): Acute: GT 2,000 mg/kg [Rabbit screen]
 BUEHLER DERMAL: Acute: Non-sensitizing [Guinea Pig]
 INTRAVENOUS (LD50): Acute: 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma
 28-Day DERMAL Subchronic: Minimal to moderate irritation at 200 to 2,000 mg/kg with no other treatment-related clinical effects observed

Biphenyl (Diphenyl or 1,1'-Biphenyl):

GAS (TCLo) Acute: 4,400 ug/m³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting
 ORAL (LD50): Acute: GT 2,600 mg/kg [Cat screen]
 ORAL (LD50): Acute: 2,400 mg/kg [Rat and Rabbit]
 ORAL (LD50): Acute: 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea
 DERMAL (LD50) Acute: GT 5,010 mg/kg [Rabbit screen]
 INTRAVENOUS (LD50). Acute: 56 mg/kg [Mouse]

Hydrogen sulfide:

GAS (TCLo): Acute: 10 ppm for 15 minutes [Human] - Eye irritation
 GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes [Human] - Respiratory irritation
 GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death
 GAS (LCLo) Acute: 5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death.

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 700°F., commonly referred to as "middle distillates, including vacuum tower condensate" have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Untreated and vacuum distillates including straight-run gas oil have been identified as skin carcinogens by IARC. These similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Untreated (straight-run and vacuum) middle distillates and light gas oils produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) assay, the in-vivo mouse SCE assay, and the in-vivo rat bone marrow cell chromosome aberrations assay, however, the in-vitro mouse lymphoma assay with and without S9 activation produced both mixed positive and negative responses. The significance of these animal study results to human health is unclear.

Studies with mice and rats have shown that some petroleum middle distillate fuels similar to this material have caused liver tumors and kidney damage and/or tumors. However, the kidney effects were sex hormone dependent and not seen in similar studies involving Guinea pigs, dogs, or monkeys. Also, the significance of the liver tumors in rodents is highly speculative relative to humans.

Studies with mice and rats have also shown that chronic exposures (8 hours/day, 7 days/week, for 24 months) to unfiltered diesel fuel exhaust produced lung tumors and lymphomas. On the basis of these studies, NIOSH recommended that complete diesel exhaust be regarded as a "potential carcinogen".

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

Numerous epidemiology studies have been carried out to test the hypothesis that lung and/or bladder cancers are associated with chronic exposure to **diesel engine exhaust**. The most comprehensive case-control and retrospective cohort studies on U S railroad workers showed an increased risk for lung cancer and this risk significantly increased with extended duration exposures. There are some indications that an elevated frequency of bladder cancer amongst bus and truck drivers may be due to diesel engine exhaust exposure

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material If spilled, this intermediate distillate, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, a volatile **aromatic hydrocarbon component (biphenyl)** may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalus cephalus*), similar middle distillates and one of this material's components showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 20 ppm in ambient saltwater Also, 96-hour LC₅₀ testing produced results from 20 ppm to 320 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Banded Killifish (*Fundulus diaphanus*), American Eel (*Anguilla rostrata*), White Perch (*Perca fluviatilis*), and Striped Mullet (*Mugil cephalis*). Based upon actual spill incident investigations, similar middle distillates and oils containing **polynuclear aromatic hydrocarbon compounds** similar to this material were shown to bioaccumulate in tissues of various fish and other aquatic organisms from less than 1 to 10 ppm levels

Environmental Fate

This middle distillate is potentially toxic to freshwater and saltwater ecosystems It will normally float on water with its lighter components evaporating rapidly In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U S National Library of Medicine (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

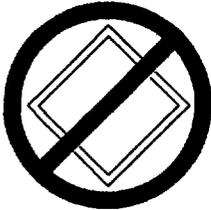
Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is not regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Petroleum oil, N.O.I.B.N.		
Hazard Class	Not a DOT controlled material	Packing Group(s)	Not applicable
		UN/NA ID	Not applicable
Reportable Quantity	Not applicable.		
Placards		Emergency Response Guide No.	Not applicable
		HAZMAT STCC No.	Not applicable
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) Health Hazard and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following component in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Biphenyl (Diphenyl) [CAS No. 92-52-4] concentration: 0.5 to 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance present in this material subject to this statute is: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] (RQ = 100 lbs. [45.36 kg]) conc.: 0.001 to 0.003%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material, especially if it is used as a fuel, contains the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it might be subject to requirements of California Health & Safety Code Section 25249.5: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] Diesel Engine Exhaust (following combustion)
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.

Vacuum Tower Condensate (C11-C25 Hydrocarbons)

Additional Regulatory Remarks

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500 14(b)(3) and 1500 83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60 489), the EPA classifies the following component of this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare" **Biphenyl (Diphenyl) [CAS No. 92-52-4]**.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 09/13/2000
Print Date Printed on 09/14/2000

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Straight-run Middle Distillate (C11-C20 Hydrocarbons)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0252
Revision Date 10/07/1999

Hazard Rankings		
	HMIS	NFPA
Health Hazard	* 2	0
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT. Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid.		
Color	Transparent to slightly opaque, water-white to pale yellow.	Odor	Characteristic, kerosene-like.

WARNING! Combustible liquid; vapor may cause flash fire! Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!

Liquid contact may cause minimal eye irritation and/or mild to severe skin irritation and inflammation! Based upon laboratory animal studies, may cause skin cancer following extended contact!

May be harmful if inhaled or absorbed through the skin!

Overexposures may cause central nervous system (CNS) depression and/or other target organ effects!

May be harmful or fatal if ingested!

Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia!

Based upon animal testing, may adversely affect reproduction!

Spills may create a slipping hazard!

If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects!

Long-term exposure to fuel exhaust particulates may cause cancer!

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Straight-run Middle Distillate (C11-C20 Hydrocarbons)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	064741442*	Medical Emergency	(918) 495-4700
CAS Number	64741-44-2	CHEMTREC Emergency	(800) 424-9300
Product Family	Petroleum Hydrocarbon Middle Distillate		
Synonyms	Straight-run Diesel; Straight-run Medium Distillate; Water White Distillate from a Petroleum Crude Still; Crude Tower Diesel, Crude Tower Middle Distillate, Untreated, Unrefined, or Raw Diesel Fuel, Untreated High-Sulfur No. 2 Fuel Oil; Unfinished Heating Oil, Furnace Oil, or Burner Fuel; C10-C20 Petroleum Hydrocarbons		

Straight-run Middle Distillate (C11-C20 Hydrocarbons)

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Straight-run Middle Distillate (Petroleum)	64741-44-2	100
2) Naphthalene	91-20-3	0.5-1.5
3) C10-C11 Alkylbenzenes	70693-06-0	1-3
4) C11 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	15-25
5) C12 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	20-40
6) Biphenyl (Diphenyl)	92-52-4	1-3
7) C10-C17 Aromatics	68333-88-0	10-20
8) C13-C20 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	20-35

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

Inhalation	Breathing mist or vapors may irritate the mucous membranes of the nose, throat, bronchi, and lungs, and may cause transient central nervous system (CNS) depression. CNS symptoms include headache, dizziness, nausea, intoxication, blurred vision, slurred speech, flushed face, confusion, weakness, fatigue, loss of consciousness, convulsions, coma, and death, depending on the concentration and/or duration of exposure.
Eye Contact	Animal test results on similar materials suggest that this product can cause minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness.
Skin Contact	Animal test results on similar materials suggest that this product can cause minimal to mild skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause mild to severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, esophagus, and stomach. It can be readily absorbed by the stomach and intestinal tract. Ingestion can produce a burning sensation of the mouth and esophagus and central nervous system depression. Symptoms of CNS depression may include nausea, vomiting, dizziness, staggering gait, drowsiness, shallow rapid pulse, diarrhea, restlessness, sedation, inadequate respiratory function, and heart irregularities. Higher doses may cause loss of consciousness and delirium prior to the onset of convulsions, coma, and death (see "Inhalation" above). A lethal dose may be as low as one-half ounce for a child and one ounce for an adult human. Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration of a small amount of liquid can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. This straight-run middle distillate is a middle distillate similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced. Naphthalene , a minor component of this product, is considered to be a toxic substance as defined by both human exposure and laboratory testing results. Biphenyl (Diphenyl) may cause liver and/or nerve damage. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases, and women attempting to conceive should avoid exposure.
Target Organs	This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the blood, liver, kidneys, and reproductive system.

**Straight-run Middle Distillate
(C11-C20 Hydrocarbons)**

Carcinogenic Potential

This material contains **middle distillates** at above 0.1% and it is considered carcinogenic by IARC and OSHA. (See Section 11.)

OSHA Health Hazard Classification				OSHA Physical Hazard Classification			
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>
						Pyrophoric	<input type="checkbox"/>
						Water-reactive	<input type="checkbox"/>
						Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-II Combustible Liquid Highly combustible ¹		
Flash Point/Method	CLOSED CUP 61° to 79°C (142° to 174°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 0.6 %	Upper Flammable Limit	AP 5.0 %
Auto-Ignition Temp.	AP 257°C (495°F)		
Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur		

Straight-run Middle Distillate (C11-C20 Hydrocarbons)

Special Properties	<p>Combustible Liquid! This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.</p> <p>A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.</p>
Extinguishing Media	<p>SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.</p>
Fire Fighting Protective Clothing	<p>Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.</p>

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid! Release causes a potential fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause a potential fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Straight-run Middle Distillate (C11-C20 Hydrocarbons)

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance

- 1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)
- 2) Naphthalene ("A4" = Not Classifiable")
- 3) Biphenyl (Diphenyl)

Applicable Workplace Exposure Levels

TWA: 100 (mg/m³) from ACGIH (TLV) [Proposed for 2000] - SKIN
 TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1999] - SKIN
 TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [1989]
 TWA: 10 (ppm) from OSHA (PEL) [1976]
 TWA: 0.2 (ppm) from ACGIH (TLV) [1999]
 TWA: 0.2 (ppm) from OSHA (PEL) [1989]

Straight-run Middle Distillate (C11-C20 Hydrocarbons)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent to slightly opaque, water-white to pale yellow	Odor	Characteristic, kerosene-like.
Specific Gravity	0.83 to 0.87 at 60°F (Water = 1)	pH	Not applicable.	Vapor Density	AP 5.2 (Air = 1 at 70°F)
Boiling Point/Range	215° to 345°C (420° to 653°F) (ASTM D-86)			Melting/Freezing Point	-25° to -15°C (-13° to 4°F) (ASTM D-97)
Vapor Pressure	LT 0.1 psia at 38°C (100°F).			Viscosity (cSt @ 40°C)	2.5 to 4 (ASTM D-445)
Solubility in Water	Negligible to slightly soluble in cold water (AP 0.005 to 0.04%).			Volatile Characteristics	Slight; no Volatile Organic Compounds (VOCs) present at 400°F (204°C)
Additional Properties	Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 72 to 88 Wt.% (ASTM D-1319); C10-C18 Aromatic Hydrocarbon Content = 12 to 28 Wt.% (ASTM D-1319); Average Density at 60°F = 7.078 lbs./gal. (ASTM D-2161); Cetane Number = GT 40 (ASTM D-613 or D-976); Saybolt Viscosity = 34.3 to 39 SUS at 100°F (ASTM D-2161); Sulfur Content = LT 0.3 Wt.% (by ASTM D-2622) or LT 0.5 Wt.% (by ASTM D-129), 90% Boiling Point Temperature = 600° to 640°F (315° to 338°C) (ASTM D-86), Evaporation Rate = LT 0.04 when n-Butyl acetate = 1.0.				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	<p>Straight-run Middle Distillate (Petroleum): GAS (LC50): Acute: 1.72 mg/L for 4 hours [Male Rat] GAS (LC50): Acute: 1.82 mg/L for 4 hours [Female Rat]. ORAL (LD50): Acute: GT 5,000 mg/kg [Rat screen] - Diarrhea, hypoactivity, and somnolence. DERMAL (LD50) Acute: GT 2,000 mg/kg [Rabbit screen] BUEHLER DERMAL: Acute: Non-sensitizing [Guinea Pig]. INTRAVENOUS (LD50): Acute: 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma. 28-Day DERMAL: Subchronic. Minimal to moderate irritation at 200 to 2,000 mg/kg with no other treatment-related clinical effects observed</p> <p>Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat] ORAL (LD50): Acute: 533 mg/kg [Mouse]. ORAL (LD50) Acute: 1,200 mg/kg [Guinea Pig]. SUBCUTANEOUS (LD50). Acute. 969 mg/kg [Mouse] INTRAVENOUS (LD50): Acute 100 mg/kg [Mouse]. INTRAPERITONEAL (LD50): Acute. 150 mg/kg [Mouse]</p> <p>Biphenyl (Diphenyl or 1,1'-Biphenyl). GAS (TCLo): Acute: 4,400 ug/m³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting. ORAL (LD50) Acute: GT 2,600 mg/kg [Cat screen]. ORAL (LD50): Acute: 2,400 mg/kg [Rat and Rabbit]. ORAL (LD50): Acute: 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea. DERMAL (LD50): Acute: GT 5,010 mg/kg [Rabbit screen]. INTRAVENOUS (LD50): Acute 56 mg/kg [Mouse].</p>
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Straight-run Middle Distillate (C11-C20 Hydrocarbons)

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 700°F., commonly referred to as "middle distillates, including straight-run middle distillate" have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Untreated and vacuum distillates including straight-run middle distillate have been identified as skin carcinogens by IARC. These similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Untreated (straight-run and vacuum) middle distillates produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) assay, the in-vivo mouse SCE assay, and the in-vivo rat bone marrow cell chromosome aberrations assay; however, the in-vitro mouse lymphoma assay with and without S9 activation produced both mixed positive and negative responses. The significance of these animal study results to human health is unclear.

Studies with mice and rats have shown that some petroleum middle distillate fuels similar to this material have caused liver tumors and kidney damage and/or tumors. However, the kidney effects were sex hormone dependent and not seen in similar studies involving Guinea pigs, dogs, or monkeys. Also, the significance of the liver tumors in rodents is highly speculative relative to humans.

Studies with mice and rats have also shown that chronic exposures (8 hours/day, 7 days/week, for 24 months) to unfiltered diesel fuel exhaust produced lung tumors and lymphomas. On the basis of these studies, NIOSH recommended that complete diesel exhaust be regarded as a "potential carcinogen".

Numerous epidemiology studies have been carried out to test the hypothesis that lung and/or bladder cancers are associated with chronic exposure to diesel engine exhaust. The most comprehensive case-control and retrospective cohort studies on U.S. railroad workers showed an increased risk for lung cancer and this risk significantly increased with extended duration exposures. There are some indications that an elevated frequency of bladder cancer amongst bus and truck drivers may be due to diesel engine exhaust exposure.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction of red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in 8 of 21 workers exposed to elevated levels of naphthalene vapors for 5 years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Also, naphthalene may cause fetal toxicity or damage. Laboratory studies produced limited evidence of fetal toxicity in pregnant female mice including decreased spleen weights.

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage. Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this kerosene, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, volatile aromatic hydrocarbon components (naphthalene and biphenyl) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalius cephalus*), similar middle distillates and some of this material's components showed a 96-hour TL_{Ms} (Median Toxic Limit) of from 10 ppm to 20 ppm in ambient saltwater. Also, 96-hour LC₅₀ testing produced results from 20 ppm to 320 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Banded Killifish (*Fundulus diaphanus*), American Eel (*Anguilla rostrata*), White Perch (*Perca fluviatilis*), and Striped Mullet (*Mugil cephalis*). Based upon actual spill incident investigations, similar middle distillates have been shown to bioaccumulate in tissues of various fish from less than 1 to 10 ppm levels.

Straight-run Middle Distillate (C11-C20 Hydrocarbons)

Environmental Fate

This middle distillate is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status This material is regulated by the U.S. Department of Transportation (DOT) only when transported in bulk containers, via vessel, or via aircraft.

Proper Shipping Name Not regulated in non-bulk container shipments, Combustible liquid, n.o.s. (Petroleum Distillates) or (Diesel Fuel) in bulk containers.

This product has a flash point temperature of between 141° and 200°F (60.5° to 93°C). For bulk shipments, it is classified as a DOT "Combustible liquid". However, according to 49 CFR 173.150(f)(2), certain transportation-related requirements, such as labeling, may not apply to this product when shipped in non-bulk packaging of less than 119 gallons capacity. However, pursuant to 49 CFR 173.150(b), "limited-quantities" offered for or transported via aircraft may be subject to DOT regulation.

Hazard Class	Not applicable or "Combustible liquid"	Packing Group(s)	Not applicable or PG III
		UN/NA ID	Not applicable or NA1993

Reportable Quantity The Reportable Quantity (RQ) substance component in this material which might require DOT HAZMAT bill-of-lading display is **Naphthalene**.

Placards

A Combustible placard may not be required for this material when transported in a non-bulk container with a maximum capacity LT 450 L (LT 119 Gal)



Emergency Response Guide No. Not applicable or 128

HAZMAT STCC No. 49 141 12

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8

**Straight-run Middle Distillate
(C11-C20 Hydrocarbons)**

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as a toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Naphthalene [CAS No. 91-20-3] concentration: 0.5 to 1.5% Biphenyl (Diphenyl) [CAS No. 92-52-4] concentration: 1 to 3%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance present in this material subject to this statute is. Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 0.5 to 1.5%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	If this material is used as a fuel, it might be considered to contain the following chemical substance which is known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it might be subject to requirements of California Health & Safety Code Section 25249.5 Diesel Engine Exhaust (following combustion).
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2
Additional Regulatory Remarks	Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children! Under Section 12(b) of TSCA: Because it contains detectable amounts of 1,1'-Biphenyl [CAS No. 92-52-4], this material might be subject to US EPA's one-time only per country export notification requirements. In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component of this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare": Biphenyl (Diphenyl) [CAS No. 92-52-4].

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	2 0
Revision Date	10/07/1999
Print Date	Printed on 02/16/2000

**Straight-run Middle Distillate
(C11-C20 Hydrocarbons)****ABBREVIATIONS**

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons) Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0258
Revision Date 8/23/2005

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	0
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Slightly opaque, pale yellow to amber. **Odor** Characteristic, heating oil-like.

WARNING!

Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!
Liquid contact may cause minimal eye irritation and/or mild to severe skin irritation and inflammation! Based upon laboratory animal studies, may cause skin cancer following extended contact!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and/or other target organ effects!
May be harmful or fatal if ingested!
Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia!
Will burn, but not ignite readily! Keep away from all ignition sources.
Spills may create a slipping hazard!
Organic vapors and potentially hydrogen sulfide gas can accumulate in the vapor space of tanks, vessels and containers.

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)	Technical Contact	(800) 525-4692
Product Number	064741431*	Medical Emergency	(800) 313-7645
CAS Number	64741-43-1	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Not applicable. Gas Oil, Atmospheric		
Synonyms	AGO; Intermediate Gas Oil; Intermediate Straight-run Distillate; Atmospheric Tower Gas Oil from a Petroleum Crude Still; Straight-run Gas Oil; SRGO; Untreated, Unrefined, or Raw Gas Oil; Untreated Diesel Fuel Blending Component; Unfinished Heating Oil, Furnace Oil, or Burner Fuel Blending Component; C11-C25 Petroleum Hydrocarbons.		

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

SECTION 2. COMPOSITION (TYPICAL)

Component Name(s)	CAS Registry No.	Concentration (%)
C10-C20 Petroleum Hydrocarbons	64741-43-1	100
C13-C30 Alkanes, Isoparaffins, and Naphthenes	Mixture	40 - 60
C12 Alkanes, Isoparaffins and Cycloalkanes		10 - 30
C12-C23 Aromatics	Mixture	10 - 25
C11 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes		5 - 15
C11 Alkylbenzenes	Mixture	1 - 3
Biphenyl (Diphenyl)	92-52-4	1 - 3
Polynuclear Aromatic Hydrocarbons (4- to 6- member condensed rings)	68487-58-6	0.1 - 1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing mist or vapors may irritate the mucous membranes of the nose, throat, bronchi, and lungs, and may cause transient central nervous system (CNS) depression. CNS symptoms include headache, dizziness, nausea, intoxication, blurred vision, slurred speech, flushed face, confusion, weakness, fatigue, loss of consciousness, convulsions, coma, and death, depending on the concentration and/or duration of exposure.
Eye Contact	Animal test results on similar materials suggest that this product can cause minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness.
Skin Contact	Animal test results on similar materials suggest that this product can cause minimal to mild skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause mild to severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	Breathing mist or heated vapors may irritate the mucous membranes of the nose, the throat, bronchi, and lungs. Aspiration into the lungs may cause chemical pneumonia. Swallowing large amounts of this material may cause stomach or intestinal upset with pain, nausea, vomiting, and/or diarrhea. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).

Chronic Health Effects Summary Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

This straight-run gas oil is a middle distillate similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced.

Biphenyl (Diphenyl) may cause liver and/or nerve damage. (See Section 11.)

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

- Conditions Aggravated by Exposure** Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases should avoid exposure.
- Target Organs** This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the liver and kidneys.
- Carcinogenic Potential** This material, or a component of this material, has been shown to cause cancer in laboratory animals. The relevance of this to humans is not clear.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
- Skin Contact** Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
- Ingestion** Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
- Notes to Physician** Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IIIB Liquid. Slightly combustible!	
Flash Point	CLOSED CUP: 96° to 104°C (205° to 220°F) (Pensky-Martens Closed Cup [ASTM D-93]).	
Lower Flammable Limit	AP 0.6 %	Upper Flammable Limit AP 5.0 %
Autoignition Temperature	AP 263° to 288°C (505° to 550°F)	
Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur.	
Special Properties		

This material releases vapors at or approaching its flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.

A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.

Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Release causes an potential fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

A spill or leak may cause a potential fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



- Eye Protection** Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.
- Hand Protection** Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.
- Body Protection** Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.
- Respiratory Protection** For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).
- General Comments** Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
C10-C20 Petroleum Hydrocarbons	ACGIH (United States, 1998). Skin TWA: 100 mg/m ³
Biphenyl (Diphenyl)	ACGIH TLV (United States). TWA: 0.2 ppm 8 hour(s). OSHA PEL Z2 (United States). TWA: 0.2 ppm 8 hour(s).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Slightly opaque, pale yellow to amber.	Odor	Characteristic, heating oil-like.
Specific Gravity	0.89 to 0.94 at 60°F (Water = 1)	pH	Not applicable.	Vapor Density	AP 10 (Air = 1 at 70°F)
Boiling Range	204° to 400°C (400° to 752°F) (ASTM D-86)			Melting/Freezing Point	-20° to -4°C (-4° to 25°F) (ASTM D-97)
				Volatility	

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

Vapor Pressure	LT 0.1 Reid-psia at 38°C (100°F).	Viscosity (cSt @ 40°C)	Slight; no Volatile Organic Compounds (VOCs) present at 400°F (204°C).
Solubility in Water	Negligible to slightly soluble in cold water (AP 0.001 to 0.01%).	7.4 to 54 (ASTM D-445)	
Flash Point	CLOSED CUP: 96° to 104°C (205° to 220°F) (Pensky-Martens Closed Cup [ASTM D-93]).		
Additional Properties	No Addition Properties.		

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Biphenyl (Diphenyl)

Studies in Humans Overexposed to Biphenyl:
Evidence of adverse effects on the liver and the nervous system have been described in studies of workers exposed to high levels for prolonged periods.

Studies in Laboratory Animals:

Evidence of adverse effects on the kidney and liver, and changes in whole blood (reduced hematocrit and hemoglobin levels) have been observed in laboratory rodents following subchronic exposure to biphenyl.

Genotoxicity & Carcinogenicity:

Biphenyl tested negative in bacteriological systems but some evidence of positive responses have been reported in mammalian cell systems in the presence of metabolic activation. The EPA has determined human and animal data are inadequate to classify the carcinogenic potential of biphenyl.

Polynuclear Aromatic Hydrocarbons (4- to 6- member condensed rings)

ORAL (LD50): Acute: >5000 mg/kg [Rat].
DERMAL (LD50): Acute: >2000 mg/kg [Rabbit].

Cancer is the most significant toxicity endpoint for PNAs. Certain PNA compounds are weak carcinogens which only become potent carcinogens after undergoing metabolism. Chronic or repeated exposure increases the likelihood of tumor initiation as well as the potential for metabolism of a PNA procarcinogen into a carcinogen. Increased incidence of tumors of the skin, bladder, lung and gastrointestinal tract have been described in individuals exposed to elevated concentrations of certain PNAs.

PNA compounds have been associated with photosensitivity and eye irritation. Inhalation exposures to PNA compounds have been associated with respiratory tract irritation, cough

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

and bronchitis. Dermal exposures may cause precancerous lesions, erythema, dermal burns, photosensitivity, acneiform lesions and irritation. Oral exposure to some PNAs have been associated with precancerous growths of the mouth (leukoplakia). Also, mild nephrotoxicity, indicated by increased kidney size, congestion and renal cortical hemorrhages, plus elevated liver function tests and histopathologic abnormalities have occurred in rats following chronic ingestion.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this kerosene, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, volatile aromatic hydrocarbon components (biphenyl) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalius cephalus*), similar middle distillates showed a 96-hour TLms (Median Toxic Limit) of from 10 ppm to 20 ppm in ambient saltwater. Also, 96-hour LC 50 testing produced results from 20 ppm to 320 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Banded Killifish (*Fundulus diaphanus*), American Eel (*Anguilla rostrata*), White Perch (*Perca fluviatilis*), and Striped Mullet (*Mugil cephalis*). Based upon actual spill incident investigations, similar middle distillates have been shown to bioaccumulate in tissues of various fish from less than 1 to 10 ppm levels.

Environmental Fate

This middle distillate is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) and Chronic (Delayed) Health Hazards.
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Biphenyl (Diphenyl) [CAS No.: 92-52-4] Concentration: 2% Polynuclear Aromatic Hydrocarbons (4- to 6- member condensed rings) [CAS No.: 68487-58-6] Concentration: 0.6%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This product or refinery stream is not known to contain chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Polynuclear Aromatic Hydrocarbons (4- to 6- member condensed rings): 0.55%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

Atmospheric Gas Oil (AGO) (C11-C25 Hydrocarbons)

Additional Regulatory Remarks

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

Under Section 12(b) of TSCA: Because it contains detectable amounts of **1,1'-Biphenyl [CAS No. 92-52-4]** this material might be subject to US EPA's one-time only per country export notification requirements.

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component of this material as a "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare": **Biphenyl (Diphenyl) [CAS No. 92-52-4]**.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 8/23/2005
Print Date Printed on 8/23/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

MATERIAL SAFETY DATA SHEET

SOUR INTERMEDIATE DISTILLATE/HYDROGEN MIXED PHASE STREAMS

MSDS No.
RS0262Rev. Date
11/07/95

LYONDELL-CITGO REFINING COMPANY, LTD.
12000 LAWNDALE AVENUE
P. O. BOX 2451
HOUSTON, TEXAS 77252-2451

IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product.

This product is considered a hazardous chemical under the OSHA Hazard Communication Rule.

I. General		
Trade Name	SOUR INTERMEDIATE DISTILLATE/HYDROGEN MIXED PHASE STREAMS	Telephone Numbers EMERGENCY 800/424-9300 CHEMTREC 800/313-7645 HOT LINE CUSTOMER SERVICE 800/525-4692 INFO ONLY
Other Names	HDS DIESEL REACTOR EFFLUENT HDS INTERMEDIATE DIESEL/HYDROGEN/HYDROGEN SULFIDE MIX DIESEL HYDRODESULFURIZATION UNIT MIXED PHASE FEEDSTOCK	
Chemical Family	PETROLEUM HYDROCARBONS/HYDROGEN/H ₂ S/NH ₄	DOT Hazardous Materials Proper Shipping Name COMPRESSED GASES, TOXIC, FLAMMABLE, N.O.
Generic Name	SOUR MIDDLE DISTILLATE AND HYDROGEN	DOT Hazard Class 2.3 (POISON GAS, FLAMMABLE GAS)
CAS No.	SEE SECTION IX	Company ID No. 111111262 UN/NA ID No. UN 1954
II. DANGER		SEE SUPPLEMENT BEGINNING ON PAGE 7
<h3 style="margin: 0;">Summary of Hazards</h3> <p>MAY CAUSE MODERATE EYE AND SKIN IRRITATION OR MORE SERIOUS SKIN DISORDERS! AVOID PROLONGED OR REPEATED LIQUID, MIST, AND VAPOR CONTACT WITH EYES, SKIN, AND RESPIRATORY TRACT. LONG-TERM TESTS SHOW THAT SIMILAR MIDDLE PETROLEUM DISTILLATES HAVE PRODUCED SKIN TUMORS ON LABORATORY ANIMALS FOLLOWING EXTENDED CONTACT. WASH THOROUGHLY AFTER HANDLING.</p> <p>MAY BE HARMFUL IF INHALED! CONTAINS HYDROGEN SULFIDE, A POISONOUS GAS! HARMFUL OR FATAL IF SWALLOWED! CONTAINS PETROLEUM DISTILLATES! IF SWALLOWED, DO NOT INDUCE VOMITING SINCE ASPIRATION INTO THE LUNGS WILL CAUSE CHEMICAL PNEUMONIA. OBTAIN PROMPT MEDICAL ATTENTION.</p> <p>EXTREMELY FLAMMABLE! OSHA/NFPA CLASS-IA FLAMMABLE GAS/LIQUID. KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME. AVOID THE "SWITCH LOADING" HAZARD. (SEE SECTION XI.).</p> <p>MAY CAUSE KIDNEY AND/OR LIVER DAMAGE BASED ON ANIMAL STUDY RESULTS! LOW BOILING POINT INTENSIFIES THE PRESSURE AND RAPID DIFFUSION HAZARD!</p>		
III. Fire and Explosion		
Flash Point (Method)	Autoignition Temperature (Method)	Flammable Limits (% Vol. in Air) At Normal Atmospheric Temperature and Pressure
LT 200° F (D-56) SEE "FIRE & EXPLOSION HAZARDS"	AP 410° F (E-659) BASED ON NFPA "FUEL OIL"	Lower AP 0.7 Upper AP 75.0 BASED ON "FUEL OIL/HYDROGEN"
Fire and Explosion Hazards	THIS GAS RELEASES FLAMMABLE VAPORS AT WELL BELOW AMBIENT TEMPERATURES AND READILY FORMS FLAMMABLE MIXTURES WITH AIR. EXPOSED TO AN IGNITION SOURCE, IT WILL BURN IN THE OPEN OR BE EXPLOSIVE IN CONFINED SPACES. ITS VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL LONG DISTANCES TO A POINT OF IGNITION, AND THEN FLASH BACK. ALKANE/CHLORINE GAS MIXTURES HAVE PRODUCED EXPLOSIONS.	
Extinguishing Media	FOAM DRY CHEMICAL CO ₂ USE OF WATER FOG/SPRAY CAN COOL THE FIRE, BUT MAY NOT ACHIEVE EXTINGUISHMENT. SHUT OFF GAS SOURCE!	WATERSPRAY INERT GAS - HALON/N ₂
		HAZARD RATING: 4 - Extreme 3 - High 2 - Moderate 1 - Slight 0 - Insignificant
		* Chronic Health Hazard - See Section IV.
Special Firefighting Procedures	FIRES INVOLVING THIS MATERIAL SHOULD NOT BE EXTINGUISHED UNLESS THE SOURCE FLOW CAN BE STOPPED IMMEDIATELY. SHUT OFF THE SOURCE AND ALLOW THE FIRE TO BURN ITSELF OUT. IF IT CANNOT BE SHUT OFF IMMEDIATELY, ALL EXPOSED EQUIPMENT AND SURFACES MUST BE COOLED WITH WATER TO PREVENT OVER-HEATING, FLASH-BACKS, OR EXPLOSIONS. CONTROL FIRE UNTIL SOURCE SUPPLY CAN BE SHUT OFF. FIREMEN MUST USE PROPER PROTECTIVE EQUIPMENT INCLUDING RESPIRATORY APPARATUS TO PROTECT AGAINST HAZARDOUS COMBUSTION PRODUCTS/OXYGEN DEFICIENCIES.	

IV. Health Hazards		SEE SUPPLEMENT BEGINNING ON PAGE 7			
Summary of Acute Hazards	LIQUID, MIST, OR VAPOR CONTACT CAN IRRITATE EYES, SKIN, AND THE RESPIRATORY AND DIGESTIVE TRACTS. IT MAY ALSO CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION.				
ROUTE OF EXPOSURE	SIGNS AND SYMPTOMS	Primary Route(s)			
Inhalation	VAPORS OR MISTS FROM THIS MATERIAL CAN IRRITATE THE NOSE, THROAT, AND LUNGS, AND CAN CAUSE SIGNS AND SYMPTOMS OF CENTRAL NERVOUS SYSTEM (CNS) DEPRESSION, DEPENDING ON THE CONCENTRATION AND DURATION OF EXPOSURE.	<input checked="" type="checkbox"/>			
Eye Contact	MILD EYE IRRITATION MAY RESULT FROM CONTACT WITH LIQUID, MIST, AND/OR VAPORS.	<input checked="" type="checkbox"/>			
Skin Absorption	NO SIGNIFICANT SYSTEMIC EFFECTS ARE EXPECTED UNDER CONDITIONS OF ANTICIPATED USE.	<input type="checkbox"/>			
Skin Irritation	CONTACT WITH LIQUID AND/OR MISTS MAY RESULT IN MODERATE SKIN IRRITATION. PROLONGED AND/OR REPEATED SKIN CONTACT MAY RESULT IN DERMATITIS OR MORE SERIOUS SKIN DISORDERS. (SEE "SUMMARY OF CHRONIC HAZARDS" BOX BELOW.)	<input checked="" type="checkbox"/>			
Ingestion	THIS MATERIAL CAN IRRITATE THE MOUTH, THROAT, AND STOMACH, AND CAUSE NAUSEA, VOMITING, DIARRHEA AND RESTLESSNESS. IF ASPIRATED INTO THE LUNGS, IT WILL CAUSE CHEMICAL PNEUMONIA.	<input type="checkbox"/>			
Summary of Chronic Hazards and Special Health Effects	THIS PRODUCT CONTAINS PETROLEUM DISTILLATES SIMILAR TO THOSE SHOWN TO PRODUCE SKIN TUMORS ON LABORATORY ANIMALS. ALL TUMORS NOTED APPEARED DURING THE LATTER PORTION OF THE TYPICAL 2-YEAR LIFESPAN OF THE ANIMALS. THERE MAY BE A SLIM POTENTIAL RISK OF SKIN CANCER TO HUMANS FROM PROLONGED OR REPEATED CONTACT WITH THIS PRODUCT. (SEE SUPPLEMENTAL SECTION XIII.) PERSONNEL WITH PRE-EXISTING CENTRAL NERVOUS SYSTEM DISEASE, SKIN DISORDERS, OR CHRONIC RESPIRATORY DISEASES SHOULD AVOID EXPOSURE TO THIS MATERIAL.				
V. Protective Equipment and Other Control Measures					
Respiratory	IF EXCESSIVE MISTS OR VAPOR RESULT FROM CONDITIONS OF USE, WEAR PROPER NIOSH/MSHA-APPROVED RESPIRATORY EQUIPMENT. THIS IS NOT EXPECTED TO OCCUR BECAUSE THIS MATERIAL POSSESSES A LOW VAPOR PRESSURE.				
Eye	EYE PROTECTION SHOULD BE WORN WHENEVER THERE IS A LIKELIHOOD OF MISTING OR SPLASHING/SPRAYING LIQUID. SUITABLE EYE WASH WATER SHOULD BE AVAILABLE. HARD CONTACT LENSES MUST NOT BE WORN.				
Skin	AVOID SKIN CONTACT. IF CONDITIONS OR FREQUENCY OF USE MAKE CONTACT UNAVOIDABLE, CLEAN AND IMPERVIOUS PROTECTIVE CLOTHING SUCH AS GLOVES, APRON, BOOTS, AND FACIAL PROTECTION SHOULD BE WORN.				
Engineering Controls	USE ADEQUATE VENTILATION TO KEEP VAPOR AND MIST CONCENTRATIONS OF THIS MATERIAL BELOW APPLICABLE EXPOSURE LIMITS. (SEE SECTIONS VI. AND XI.). ALL EQUIPMENT SHOULD COMPLY WITH NATIONAL ELECTRICAL CODE (NEC) STANDARDS.				
Other Hygienic and Work Practices	USE GOOD PERSONAL HYGIENE PRACTICES. WASH HANDS BEFORE EATING, DRINKING, SMOKING OR USE OF TOILET FACILITIES. IMMEDIATELY REMOVE SOILED CLOTHING AND WASH THOROUGHLY BEFORE REUSE. CLEAN OR DISCARD CONTAMINATED LEATHER GOODS. RESPIRATOR USE SHOULD COMPLY WITH OSHA STANDARD 29 CFR 1910.134 OR EQUIVALENT. SEE SECTION XI. FOR ADDITIONAL INFORMATION.				
VI. Occupational Exposure Limits		SEE ADDITIONAL DATA BEGINNING ON PAGE 7			
Substance	Source	Date	Type	Value/Units	Time
HYDROGEN SULFIDE	OSHA	1989	PEL	10 PPM	8 HRS
			STEL	15 PPM	15 MIN
	ACGIH	1995	TLV	10 PPM	8 HRS
			STEL	15 PPM	15 MIN
AMMONIA	OSHA	1989	PEL	25 PPM	8 HRS
			STEL	35 PPM	15 MIN
	ACGIH	1995	TLV	25 PPM	8 HRS
			STEL	35 PPM	15 MIN
HYDROGEN/METHANE - "SIMPLE ASPHYXIANTS" STODDARD SOLVENT (SEE SECTION XI.)	ACGIH	1995			
	OSHA	1989	PEL	100 PPM	8 HRS
	ACGIH	1995	TLV	100 PPM	8 HRS
TRIMETHYL BENZENE	OSHA	1989	PEL	25 PPM	8 HRS
	ACGIH	1995	TLV	25 PPM	8 HRS

SOUR INTERMEDIATE DISTILLATE/HYDROGEN MIXED PHASE STREAMS

MSDS No.
RSD262
Rev. Date
11/07/95**VII. Emergency and First Aid**

Inhalation	IMMEDIATELY MOVE PERSONNEL TO AREA OF FRESH AIR. FOR RESPIRATORY DISTRESS, GIVE AIR, OXYGEN, OR ADMINISTER CPR (CARDIOPULMONARY RESUSCITATION), IF NECESSARY. OBTAIN MEDICAL ATTENTION FOR ANY BREATHING DIFFICULTIES.
Eye Contact	FLUSH WITH CLEAN LOW-PRESSURE WATER FOR AT LEAST 15 MINUTES. RETRACT THE EYELIDS OFTEN. OBTAIN MEDICAL ATTENTION.
Skin Contact	PROMPTLY REMOVE CONTAMINATED CLOTHING AND THOROUGHLY CLEAN BEFORE REUSE. CLEAN OR DISCARD CONTAMINATED LEATHER GOODS. THOROUGHLY WASH AFFECTED SKIN WITH SOAP AND WATER.
Ingestion	RINSE MOUTH WITH WATER. IF VICTIM IS CONSCIOUS AND ALERT, GIVE 1-2 GLASSES OF WATER OR MILK. DO NOT INDUCE VOMITING UNLESS DIRECTED BY MEDICAL PERSONNEL DUE TO RISK OF LUNG DAMAGE. PROMPTLY OBTAIN MEDICAL ATTENTION.
Emergency Medical Treatment Procedures	SEE ABOVE PROCEDURES.

VIII. Spill and Disposal

Precautions if Material is Spilled or Released	CONTAIN SPILL. REMOVE ALL IGNITION SOURCES AND SAFELY STOP FLOW OF SPILL. SPILL MAY CREATE SLIPPING HAZARDS. PREVENT FROM ENTERING ALL BODIES OF WATER, IF POSSIBLE. EVACUATE ALL NON-ESSENTIAL PERSONNEL. IN URBAN AREAS, CLEANUP AS SOON AS POSSIBLE; IN NATURAL ENVIRONMENTS, CLEANUP ON ADVICE FROM ECOLOGISTS. THIS MATERIAL WILL FLOAT ON WATER. ABSORBENT MATERIAL AND PADS CAN BE USED. COMPLY WITH ALL APPLICABLE LAWS. SPILLS MAY NEED TO BE REPORTED TO THE NATIONAL RESPONSE CENTER (800/424-8802). THE SPILLED MATERIAL AND ANY WATER OR SOIL WHICH IT HAS CONTACTED MAY BE HAZARDOUS TO ANIMAL/AQUATIC LIFE.
Waste Disposal Methods	MAXIMIZE PRODUCT RECOVERY FOR REUSE OR RECYCLING. UNUSED LIQUID PRODUCT IS LIKELY AN EPA "IGNITABLE HAZARDOUS WASTE" (D001). USE APPROVED TREATMENT, TRANSPORTERS, AND DISPOSAL SITES IN COMPLIANCE WITH ALL APPLICABLE LAWS. IF SPILL IS INTRODUCED INTO A WASTEWATER SYSTEM, THE CHEMICAL AND BIOLOGICAL OXYGEN DEMAND WILL LIKELY INCREASE. SPILL MATERIAL IS BIODEGRADABLE IF GRADUALLY EXPOSED TO MICROORGANISMS. POTENTIAL DISPOSAL METHODS INCLUDE INCINERATION AND LAND DISPOSAL, IF PERMITTED.

IX. Components (This may not be a complete list of components)

Component Name	CAS No.	Carcinogen##		Composition amount (Vol.) (See Qualification on Page 4.)	
TWO PHASE STREAM		N/AP	EQ	100 PERCENT	
GAS PHASE:		N/AP	AP	40 TO	60 PERCENT
HYDROGEN	1333-74-0	N/AP	AP	70 TO	85 PERCENT
METHANE	74-82-8	N/AP	AP	5 TO	15 PERCENT
HYDROGEN SULFIDE	7783-06-4	N/AP	AP	2 TO	5 PERCENT
AMMONIA	7664-41-7	N/AP	AP	0.5 TO	2.0 PERCENT
LIQUID PHASE:		N/AP	AP	40 TO	60 PERCENT
STRAIGHT-RUN MIDDLE DISTILLATE (PETROLEUM)	64741-44-2*	N/AP	AP	0 TO	60 PERCENT
LIGHT THERMAL-CRACKED DISTILLATE	64741-82-8*	N/AP	AP	0 TO	60 PERCENT
LIGHT CATALYTIC CRACKED DISTILLATE WHICH CONTAINS:	64741-59-9*	N/AP	AP	0 TO	60 PERCENT
HYDROCARBONS BOILING BETWEEN 325° F. AND 690° F.		N/AP	AP	40 TO	60 PERCENT
TRIMETHYL BENZENE (TOTAL OF ALL ISOMERS)	25551-13-7*	N/AP	AP	1 PERCENT	
1,2,4-TRIMETHYLBENZENE (PSEUDOCUMENE)	95-63-6	N/AP	LT	1 PERCENT	
NAPHTHALENE	91-20-3	N/AP	AP	1 TO	3 PERCENT
BIPHENYL (DIPHENYL)	92-52-4	N/AP	AP	1 PERCENT	

Compositions given are typical values, not specifications.

##Listed By: 1 = NTP, 2 = IARC, 3 = OSHA, 4 = Other

X. Physical and Chemical Data			
Boiling Point 320° TO 555° F	Viscosity Units, Temp. (Method) AP 2 CST AT 100° F (D-445)		Dry Point N/DA
Freezing Point LT -50° F	Vapor Pressure (REID-PSIA AT 100° F) LT 0.1		Volatile Characteristics SLIGHT
Specific Gravity (H₂O = 1 at 39.2° F) AP 0.79 TO 0.83	Vapor Sp. Gr. (Air = 1.0 at 60°-90° F) AP 6	Solubility in Water NEGLIGIBLE	pH N/AP
Hazardous Polymerization NOT EXPECTED TO OCCUR	Other Chemical Reactivity N/P		Stability STABLE
Other Physical and Chemical Properties	SULFUR CONTENT = LT 0.6 WT.% (ASTM D-2622); POUR POINT TEMPERATURE = LT 0° F.; VISCOSITY @ -4° F. = LT 8 CENTISTOKES (D-2602).		
Appearance and Odor	NEARLY COLORLESS TO LIGHT YELLOW-COLORED LIQUID; KEROSENE ODOR.		
Conditions to Avoid	HEAT, SPARKS, AND OPEN FLAME.		
Materials to Avoid	STRONG ACIDS, ALKALIES, AND OXIDIZERS SUCH AS LIQUID CHLORINE AND OXYGEN.		
Hazardous Decomposition Products	EXCESSIVE HEATING AND/OR INCOMPLETE COMBUSTION MAY PRODUCE CARBON MONOXIDE, CARBON DIOXIDE, AND OTHER HARMFUL GASES/VAPORS INCLUDING OXIDES AND/OR OTHER COMPOUNDS OF SULFUR.		
XI. Additional Precautions			
Handling, Storage, and Decontamination Procedures	<p>SPECIAL SLOW LOAD PROCEDURES FOR "SWITCH LOADING" MUST BE FOLLOWED TO AVOID THE STATIC IGNITION HAZARD THAT CAN EXIST WHEN THIS MATERIAL IS LOADED INTO TANKS PREVIOUSLY CONTAINING GASOLINE OR OTHER LOW FLASH POINT PRODUCTS. (SEE A.P.I. PUBLICATION 2003.) KEEP CONTAINERS CLOSED AND AWAY FROM HEAT AND IGNITION SOURCES! ALL ELECTRICAL EQUIPMENT IN AREAS WHERE PRODUCT IS STORED/HANDLED SHOULD BE INSTALLED IN ACCORDANCE WITH APPLICABLE REQUIREMENTS OF THE NATIONAL ELECTRIC CODE, N.E.C. DO NOT USE THIS PRODUCT AS A CLEANING AGENT. EMPTY CONTAINERS RETAIN SOME LIQUID AND VAPOR RESIDUES, AND HAZARD PRECAUTIONS MUST BE OBSERVED WHEN HANDLING EMPTY CONTAINERS.</p> <p>WARNING: USE OF ANY HYDROCARBON FUEL IN SPACES WITHOUT ADEQUATE VENTILATION MAY RESULT IN GENERATION OF HAZARDOUS LEVELS OF COMBUSTION PRODUCTS AND INADEQUATE OXYGEN LEVELS FOR BREATHING.</p>		
General Comments	<p>SINCE SPECIFIC EXPOSURE STANDARDS/CONTROL LIMITS HAVE NOT BEEN ESTABLISHED FOR THIS MATERIAL, THE EXPOSURE LIMITS LISTED IN SECTION VI. ARE SUGGESTED AS MINIMUM CONTROL GUIDELINES.</p> <p>THIS MATERIAL CONTAINS A "PETROLEUM DISTILLATE", AS DEFINED BY 16 CFR 1500.14(B)(3) AND 1500.83(A)(13), WHICH REQUIRES SPECIAL LABELING PURSUANT TO THE FEDERAL HAZARDOUS SUBSTANCES ACT AND RELATED STATUTES AND REGULATIONS, IF IT IS DISTRIBUTED IN A MANNER INTENDED, OR PACKAGED IN A FORM SUITABLE, FOR USE IN THE HOUSEHOLD OR BY CHILDREN.</p> <p>SOME OF THE INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE MIXTURE ITSELF.</p>		
<p>--- Note --- Qualifications: EQ = Equal AP = Approximately N/P = No Applicable Information Found LT = Less Than UK = Unknown N/AP = Not Applicable GT = Greater Than TR = Trace N/DA = No Data Available</p>			
Disclaimer of Liability			
<p>The information in this MSDS was obtained from sources which we believe are reliable. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS.</p> <p>The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.</p> <p>This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable.</p>			

SOUR INTERMEDIATE DISTILLATE/HYDROGEN MIXED PHASE STREAMS

MSDS No
RS0262
Rev. Date
11/07/95**XII.****Regulatory Information****SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), TITLE III****SECTION 311/312 HAZARD CATEGORIES**IMMEDIATE (ACUTE) HEALTH HAZARD
FIRE HAZARDDELAYED (CHRONIC) HEALTH HAZARD
SUDDEN RELEASE OF PRESSURE**SECTION 313**

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA TITLE III, SECTION 313 AND 40 CFR 372:

AMMONIA
1,2,4-TRIMETHYLBENZENE (PSEUDOCUMENE)
NAPHTHALENE
BIPHENYL (DIPHENYL)**TOXIC SUBSTANCES CONTROL ACT (TSCA)**

ALL COMPONENTS OF THIS PRODUCT ARE LISTED ON THE TSCA INVENTORY. BECAUSE THIS PRODUCT CONTAINS C9 AROMATIC HYDROCARBONS AND 1,1-BIPHENYL (DIPHENYL), IT IS SUBJECT TO SECTION 12(B) EXPORT NOTIFICATION REQUIREMENTS.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF CERCLA:

HYDROGEN SULFIDE
AMMONIA
NAPHTHALENE
BIPHENYL (DIPHENYL)**REPORTABLE QUANTITY (RQ), LBS**100#/45.4KG
100#/45.4KG
100#/45.4KG
100#/45.4KG**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 - PROPOSITION 65**

BASED ON INFORMATION CURRENTLY AVAILABLE, THIS PRODUCT IS NOT KNOWN TO CONTAIN ANY CHEMICALS CURRENTLY LISTED AS CARCINOGENS OR REPRDDUCTIVE TOXINS UNDER CALIFORNIA PROPOSITION 65 AT LEVELS WHICH WOULD BE SUBJECT TO THE PROPOSITION. IF YOU REFORMULATE OR FURTHER PROCESS THIS PRODUCT, YOU SHOULD FURTHER EVALUATE THIS PRODUCT BASED UPON SUCH REFORMULATION OR PROCESSING, AS WELL AS UPON ITS FINAL COMPOSITION AND USE.

SOUR INTERMEDIATE DISTILLATE/HYDROGEN MIXED PHASE STREAMS

MSDS No.
RS 262
Rev. Date
11/07/95

XIII.

Label Information

Manufacturer:	LYONDELL-CITGO REFINING COMPANY, LTD. 12000 LAWDALE AVENUE P. O. BOX 2451 HOUSTON, TEXAS 77252-2451	Telephone Numbers EMERGENCY 800/424-9300 CHEMTREC 800/313-7645 HOT LINE CUSTOMER SERVICE 800/525-4692 INFO ONLY
Use Statement:	FOR INDUSTRIAL USE ONLY!	
Signal Word:	DANGER	
Physical Hazards:	EXTREMELY FLAMMABLE GAS! EXPLOSIVE SLIPPING HAZARD ON SMOOTH, HARD WALKING AREA.	HIGHLY COMPRESSED GAS SUDDEN RELEASE/RAPID DIFFUSION HAZARD CORROSIVE TO SOME METALS
Health Hazards:	HIGH INGESTION, SKIN, AND INHALATION HAZARD SKIN, EYE, AND MUCOUS MEMBRANE IRRITANT MAY CAUSE LIVER AND/OR KIDNEY DAMAGE MAY CAUSE ALLERGIC REACTION SIMILAR MATERIAL CAUSES CANCER IN TEST ANIMALS	VAPOR REDUCES OXYGEN AVAILABLE FOR BREATHING! MIST/VAPOR MAY IRRITATE NOSE, THROAT, AND LUNGS IF ASPIRATED, MAY CAUSE CHEMICAL PNEUMONIA MAY PARALYZE THE DIAPHRAGM MUSCLE MAY AFFECT REPRODUCTION
Precautionary Measures:	DO NOT HANDLE NEAR HEAT, SPARKS, OR OPEN FLAME. SPILL/LEAK CAN CAUSE FIRE/EXPLOSION. STORE IN TIGHTLY CLOSED CONTAINERS. DO NOT BREATHE GAS. USE ONLY WITH ADEQUATE VENTILATION/PERSONAL PROTECTION. HAVE AVAILABLE EMERGENCY SELF-CONTAINED OR SUPPLIED AIR RESPIRATOR. AVOID CONTACT WITH EYES, SKIN, AND CLOTHING. WASH THOROUGHLY AFTER HANDLING. PREVENT CONTACT WITH FOOD, CHEWING, OR SMOKING MATERIALS. DO NOT TAKE INTERNALLY.	
DOT Information:	UN/NA ID Number-- UN 1954 Hazard Class-- 2.3 (POISON GAS, FLAMMABLE GAS) Proper Shipping-- COMPRESSED GASES, TOXIC, FLAMMABLE, N.O.S. (HYDROGEN SULFIDE, METHANE)	
Instructions:	FOAM DRY CHEMICAL CO2	WATERSPRAY INERT GAS - HALON/N2
First Aid -Inhalation	IMMEDIATELY MOVE PERSONNEL TO AREA OF FRESH AIR. FOR RESPIRATORY DISTRESS, GIVE AIR, OXYGEN, OR ADMINISTER CPR (CARDIOPULMONARY RESUSCITATION), IF NECESSARY. OBTAIN MEDICAL ATTENTION FOR ANY BREATHING DIFFICULTIES.	
-Eye Contact	FLUSH WITH CLEAN LOW-PRESSURE WATER FOR AT LEAST 15 MINUTES. RETRACT THE EYELIDS OFTEN. OBTAIN MEDICAL ATTENTION.	
-Skin Contact	PROMPTLY REMOVE CONTAMINATED CLOTHING AND THOROUGHLY CLEAN BEFORE REUSE. CLEAN OR DISCARD CONTAMINATED LEATHER GOODS. THOROUGHLY WASH AFFECTED SKIN WITH SOAP AND WATER.	
-Ingestion	RINSE MOUTH WITH WATER. IF VICTIM IS CONSCIOUS AND ALERT, GIVE 1-2 GLASSES OF WATER OR MILK. DO NOT INDUCE VOMITING UNLESS DIRECTED BY MEDICAL PERSONNEL DUE TO RISK OF LUNG DAMAGE. PROMPTLY OBTAIN MEDICAL ATTENTION.	
In case of spill,	CONTAIN SPILL. REMOVE ALL IGNITION SOURCES AND SAFELY STOP FLOW OF SPILL. SPILL MAY CREATE SLIPPING HAZARDS. PREVENT FROM ENTERING ALL BODIES OF WATER, IF POSSIBLE. EVACUATE ALL NON-ESSENTIAL PERSONNEL. IN URBAN AREAS, CLEANUP AS SOON AS POSSIBLE; IN NATURAL ENVIRONMENTS, CLEANUP ON ADVICE FROM ECOLOGISTS. THIS MATERIAL WILL FLOAT ON WATER. ABSORBENT MATERIAL AND PADS CAN BE USED. COMPLY WITH ALL APPLICABLE LAWS. SPILLS MAY NEED TO BE REPORTED TO THE NATIONAL RESPONSE CENTER (800/424-8802). THE SPILLED MATERIAL AND ANY WATER OR SOIL WHICH IT HAS CONTACTED MAY BE HAZARDOUS TO ANIMAL/AQUATIC LIFE.	
Protective Equipment:	IF EXCESSIVE MISTS OR VAPOR RESULT FROM CONDITIONS OF USE, WEAR PROPER NIOSH/MSHA-APPROVED RESPIRATORY EQUIPMENT. THIS IS NOT EXPECTED TO OCCUR	
-Respiratory	EYE PROTECTION SHOULD BE WORN WHENEVER THERE IS A LIKELIHOOD OF MISTING OR SPLASHING/SPRAYING LIQUID. SUITABLE EYE WASH WATER SHOULD BE AVAILABLE.	
-Eye	AVOID SKIN CONTACT. IF CONDITIONS OR FREQUENCY OF USE MAKE CONTACT UNAVOIDABLE, CLEAN AND IMPERVIOUS PROTECTIVE CLOTHING SUCH AS GLOVES.	
-Skin		

SOUR INTERMEDIATE DISTILLATE/HYDROGEN MIXED PHASE STREAMS

MSDS No
RS0262
Rev. Date
11/07/95Continued from
Section VI Page 2**Occupational Exposure Limits**

Substance	Source	Date	Type	Value/Units	Time
NAPHTHALENE	OSHA	1989	PEL	10 PPM	8 HRS
			STEL	15 PPM	15 MIN
	ACGIH	1995	TLV	10 PPM	8 HRS
			STEL	15 PPM	15 MIN
DIPHENYL BIPHENYL (DIPHENYL)	OSHA	1989	PEL	0.2 PPM	8 HRS
	ACGIH	1995	TLV	0.2 PPM	8 HRS

XIV. Supplement**ACUTE AND CHRONIC EFFECTS (CONTINUED FROM SECTIONS II. AND IV.)**

THIS PRODUCT CONTAINS A PETROLEUM DISTILLATE, AND AS WITH MANY PETROLEUM PRODUCTS, IT MAY CAUSE IRRITATION TO THE EYES, LUNGS, OR SKIN AFTER PROLONGED OR REPEATED EXPOSURE. EXTREME EXPOSURE OR ASPIRATION INTO THE LUNGS MAY CAUSE PNEUMONIA. OVEREXPOSURE MAY CAUSE WEAKNESS, HEADACHE, NAUSEA, CONFUSION, BLURRED VISION, DROWSINESS AND OTHER NERVOUS SYSTEM EFFECTS; GREATER EXPOSURE MAY CAUSE DIZZINESS, SLURRED SPEECH, FLUSHED FACE, UNCONSCIOUSNESS, OR CONVULSIONS.

NAPHTHALENE IS A POTENTIAL IRRITANT TO EYES, SKIN, AND LUNGS AND MAY DAMAGE THE EYES (CATARACTS AND/OR OPTICAL NEURITIS), BLOOD (HEMOLYTIC ANEMIA), AND KIDNEY FOLLOWING PROLONGED OR REPEATED EXPOSURE. NAPHTHALENE MAY ALSO CAUSE FETAL TOXICITY OR DAMAGE. THE NATIONAL TOXICOLOGY PROGRAM (NTP) HAS IDENTIFIED NAPHTHALENE AS HAVING "SOME EVIDENCE OF CARCINOGENIC ACTIVITY" IN LABORATORY ANIMALS.

BIPHENYL (DIPHENYL) INHALATION OVEREXPOSURES HAVE CAUSED POISONING CHARACTERIZED BY LIVER AND CENTRAL AND/OR PERIPHERAL NERVE DAMAGE. DEATHS RESULTED FROM LIVER ATROPHY. BIPHENYL VAPORS HAVE ALSO CAUSED TRANSIENT NAUSEA, VOMITING, FLACCID PARALYSIS, AND/OR BRONCHITIS.

TRIMETHYLBENZENES ARE PRIMARY SKIN IRRITANTS AND MAY CAUSE ASTHMATIC BRONCHITIS AND/OR ANEMIA. BASED UPON ANIMAL REPRODUCTIVE/DEVELOPMENTAL STUDIES, TRIMETHYLBENZENES MAY CAUSE FETAL TOXICITY.

THIS PRODUCT MAY HAVE A TOXIC DOSE AS LOW AS 1 OUNCE TO 1 PINT FOR A HUMAN ADULT. INGESTION OF LESS THAN 1 OUNCE WITH RETENTION MAY PRODUCE GENERAL DEPRESSION, SEDATION, INADEQUATE RESPIRATORY AND/OR CARDIAC FUNCTION, AND POSSIBLY, COMA.

MATERIALS SIMILAR TO SOME COMPONENTS IN THIS PRODUCT WERE FOUND TO BE MUTAGENIC IN "IN VITRO" AND "IN VIVO" TESTS. THE RELATIONSHIP BETWEEN THESE RESULTS AND POSSIBLE HUMAN EFFECTS IS NOT KNOWN.

STUDIES WITH MICE OR RATS HAVE SHOWN THAT SOME PETROLEUM DISTILLATE FUELS HAVE CAUSED DAMAGE AND/OR TUMORS TO KIDNEYS AND LIVER. HOWEVER, THE KIDNEY EFFECTS WERE SEX HORMONAL DEPENDENT AND NOT SEEN IN SIMILAR STUDIES INVOLVING GUINEA PIGS, DOGS, OR MONKEYS. ALSO, THE SIGNIFICANCE OF LIVER TUMORS IN RODENTS IS HIGHLY SPECULATIVE.

LIFETIME MOUSE SKIN PAINTING STUDIES HAVE SHOWN THAT PETROLEUM MIDDLE DISTILLATES (BOILING RANGE OF 180°F TO 700°F; AROMATIC OR HEAVY NAPHTHAS, KEROSENE, JET FUEL, DIESEL FUEL, ETC.) CAN CAUSE SKIN TUMORS WHEN REPEATEDLY APPLIED AND NEVER WASHED FROM THE ANIMAL'S SKIN. THE RELATIVE SIGNIFICANCE OF THIS TO HUMAN HEALTH IS UNCERTAIN SINCE THE PETROLEUM DISTILLATES WERE NOT WASHED FROM THE SKIN AND RESULTING SKIN EFFECTS (IRRITATION, CELL DAMAGE, ETC.) MAY PLAY A ROLE IN THE WEAK TUMORIGENIC RESPONSE. A FEW STUDIES HAVE SHOWN THAT WASHING THE ANIMAL'S SKIN WITH SOAP AND WATER BETWEEN TREATMENTS GREATLY REDUCES THE CARCINOGENIC EFFECT OF SOME PETROLEUM OILS.

STUDIES IN MICE AND RATS HAVE SHOWN THAT CHRONIC EXPOSURE (8 HOURS/DAY, 7 DAYS/WEEK, 24 MONTHS) TO UNFILTERED DIESEL EXHAUST PRODUCED TUMORS OF THE LUNG AND ALSO LYMPHOMAS. ON THE BASIS OF THESE STUDIES, NIOSH RECOMMENDS THAT COMPLETE DIESEL EXHAUST BE REGARDED AS A "POTENTIAL CARCINOGEN."

NUMEROUS EPIDEMIOLOGICAL STUDIES HAVE BEEN CARRIED OUT TO TEST THE HYPOTHESIS THAT LUNG AND BLADDER CANCERS ARE ASSOCIATED WITH EXPOSURE TO DIESEL EXHAUST. THE MOST COMPREHENSIVE CASE-CONTROL AND RETROSPECTIVE COHORT STUDIES ON U.S. RAILROAD WORKERS SHOWED INCREASED RISK FOR LUNG CANCER. IN THE COHORT STUDY, THE RISK INCREASED SIGNIFICANTLY WITH DURATION OF EXPOSURE. THERE ARE ALSO SOME INDICATIONS THAT AN ELEVATED FREQUENCY OF BLADDER CANCER IN TRUCK AND BUS DRIVERS MAY BE DUE TO DIESEL EXHAUST EXPOSURES.

D.O.T. HAZARDOUS MATERIALS PROPER SHIPPING NAME

THIS PRODUCT HAS A FLASH POINT OF BETWEEN 100° AND 140°F. (38°-60°C.). FOR BULK SHIPMENTS, ITS D.O.T. HAZARDOUS MATERIALS PROPER SHIPPING NAME IS "FLAMMABLE LIQUID, N.O.S. (KEROSENE)". HOWEVER, ACCORDING TO 49 CFR 173.120 AND 173.150, THIS PRODUCT MAY BE RECLASSIFIED AS A "COMBUSTIBLE LIQUID" AND EXCEPTED FROM LABELING REQUIREMENTS WHEN SHIPPED IN NON-BULK "LIMITED QUANTITY" CONTAINERS OF

XIV.**Supplement Continued**

LESS THAN 119 GALLONS. THIS PROVISION DOES NOT APPLY TO "LIMITED QUANTITY" CONTAINERS OFFERED FOR TRANSPORTATION OR TRANSPORTED BY VESSEL OR AIRCRAFT. IT IS RECOMMENDED THAT "FLAMMABLE LIQUID" PRODUCTS WHICH ARE RECLASSIFIED BE SO IDENTIFIED ON THE BILL-OF-LADING AS "COMBUSTBLE LIQUID, N.O.S. (KEROSENE)" WITH AN IDENTIFICATION NUMBER OF "NA 1993".



Atmospheric Tower Light Gas Oil (ALGO)

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0265
Revision Date 10/01/2002

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Transparent; water-white to slightly yellow. **Odor** Characteristic, kerosene-like.

WARNING! Combustible liquid; vapor may cause flash fire. Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.

Liquid contact may cause minimal to mild eye and/or mild to severe skin irritation and inflammation.

Based upon laboratory animal studies, may cause skin cancer following extended contact.

May be harmful if inhaled or absorbed through the skin.

Overexposures may cause central nervous system (CNS) depression and/or other target organ effects.

May be harmful or fatal if ingested.

Aspiration into the lungs can cause pulmonary edema and lipid or chemical pneumonia.

Spills may create a slipping hazard.

If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects.

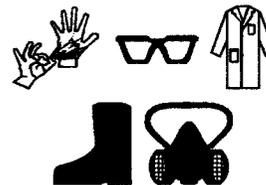
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Atmospheric Tower Light Gas Oil (ALGO)	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	008008206*	Medical Emergency	(800) 313-7645 or (918) 495-4700
CAS Number	8008-20-6	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Petroleum Hydrocarbon Middle Distillate		
Synonyms	Atmospheric Tower Light Distillate; Straight-run Light Distillate; 533 Water White Distillate; 533 Crude Still Light Gas Oil; Grade "A" Crude Unit Light Gas Oil; 633 HDS Unit Feed; Straight-run Kerosene; Kerosine (Petroleum); C10-C16 Petroleum Hydrocarbons.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Kerosene (Petroleum)	8008-20-6	100
2) C10 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	25-50
3) Naphthalene	91-20-3	1-3
4) C10-C11 Alkylbenzenes	70693-06-0	10-20
5) C11 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	10-20
6) C12 Alkanes, Isoparaffins, and Cycloalkanes	Mixture	5-15
7) Biphenyl (Diphenyl)	92-52-4	1-3
8) C12-C16 Aromatic Hydrocarbons	Mixture	1-10
9) C13-C16 Alkanes, Isoparaffins, Cycloalkanes, and Naphthenes	Mixture	5-20

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results on similar materials suggest that this material can cause minimal to mild eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results on similar materials suggest that this material can cause mild to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

This kerosine is a middle distillate similar to those shown to produce skin tumors on laboratory animals following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Toxic effects are unlikely to occur if good personal hygiene is practiced.

Naphthalene is considered to be a toxic substance as defined by both human exposure and laboratory testing results. And, based upon animal testing, it might be considered carcinogenic.

Biphenyl (Diphenyl) may cause liver and/or nerve damage. (See Section 11.)

Conditions Aggravated by Exposure Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired liver or kidney function, or chronic respiratory diseases should avoid exposure.

Atmospheric Tower Light Gas Oil (AL)

Target Organs

This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the blood, liver, kidneys, and reproductive system.

Carcinogenic Potential

This material contains naphthalene at concentrations above 0.1%. Naphthalene is considered possibly carcinogenic to humans by IARC. (See Section 11.)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	<p>Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-II Combustible Liquid. Highly combustible!		
Flash Point Method	CLOSED CUP: 55° to 60°C (131° to 140°F). [Pensky-Martens (ASTM D-93)]		
Lower Flammable Limit	AP 0.7%	Upper Flammable Limit	AP 5.0%
Autoignition Temperature	AP 210°C (410°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		

Atmospheric Tower Light Gas Oil (AL)

Special Properties

Combustible Liquid! This material releases vapors at or approaching the flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.

A static electrical charge can accumulate as a result of transfer flow or agitation. Discharge (static spark) can ignite vapors, especially in cold, dry weather conditions. Special slow load and monitoring procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this material is loaded into tanks previously containing gasoline or other low flash point products. To reduce this hazard, receiving containers should always be grounded and the loading nozzle must be kept in contact with the container during the entire filling process. Do not fill any portable container in or on a vehicle without proper bonding.

Extinguishing Media

SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). **LARGE FIRE:** Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.

Protection of Fire Fighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

Atmospheric Tower Light Gas Oil (AL)

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, Viton®, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

Warning! Use of this hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Atmospheric Tower Light Gas Oil (AL)

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Diesel fuel/Kerosene ("A3" Animal Carcinogen)	TWA: 100 (mg/M ³) from ACGIH (TLV) - SKIN [Proposed]
2) Oil mist, mineral	TWA: 5 STEL: 10 (mg/M ³) from ACGIH (TLV)
	TWA: 5 (mg/M ³) from OSHA (PEL)
3) Naphthalene	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) - SKIN
	TWA: 10 STEL: 15 (ppm) from OSHA (PEL) [Proposed]
	TWA: 10 (ppm) from OSHA (PEL)
4) Biphenyl (Diphenyl)	TWA: 0.2 (ppm) from ACGIH (TLV)
	TWA: 0.2 (ppm) from OSHA (PEL) [Proposed]
5) Diesel exhaust, particulate aerodynamic diameter < 1 um ("A2" and "Z2" Suspected Human Carcinogen)	TWA: 0.05 (mg/M ³) from ACGIH (TLV) [Proposed]
	TWA: 0.02 (mg/M ³) from OSHA (PEL) [Proposed]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color Transparent; water-white to slightly yellow.	Odor	Characteristic, kerosene-like.
Specific Gravity	0.82 to 0.84 at 60°F (Water = 1)	pH Not applicable.	Vapor Density	4.5 to 5.0 (Air = 1 at 70°F)
Boiling Point/Range	174° to 293°C (345° to 560°F) [ASTM D-86]		Melting/Freezing Point	< -40°C (-40° F) (ASTM D-2386)
Vapor Pressure	1.6 to 2.0 mm Hg at 20°C (68°F) or 0.1 to 0.5 Reid-psi(a) at 100°F (38°C).		Viscosity (cSt @ 40°C)	1.4 to 2.2 at 40°C (ASTM D-445) and < 8 cSt at -20°C.
Solubility in Water	Negligible to slightly soluble in cold water (0.005 to 0.04%).		Volatile Characteristics	Volatile Organic Compounds (VOCs) Content = 100%; 820 to 830 gm/L.
Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 69 to 88 Wt. % [ASTM D-1319]; C10-C16 Aromatic Hydrocarbon Content = 12 to 31 Wt. % [ASTM D-1319]; Average Density at 60°F = 6.911 lbs./gallon [ASTM D-2161]; Saybolt Viscosity = 30.6 to 33.3 SUS at 100°F [ASTM D-2161]; Sulfur Content = < 0.3 Wt. % [by ASTM D-2622, D-1552, or D-1266]; 90% Boiling Point Temperature = AP 500°F (260°C) [ASTM D-86]; Dry Point Temperature = AP 555°F (290°C) [ASTM D-86]; Evaporation Rate = AP 0.04 when n-Butyl acetate = 1.0; Net Heat of Combustion Value = > 18,400 Btu/lb. [ASTM D-1405 or D-2382].			

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalies, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition; and, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Atmospheric Tower Light Gas Oil (AL)

Kerosine (Petroleum):

ORAL (LD ₅₀):	Acute: > 5,000 mg/kg [Rat screen] - Diarrhea, hypoactivity, and somnolence.
ORAL (LD ₅₀):	Acute: 2,835 mg/kg [Rabbit] - Respiratory stimulation and muscle weakness.
ORAL (LD ₅₀):	Acute: 20 mg/kg [Guinea Pig] - Respiratory stimulation and muscle weakness.
GAS (LC ₅₀):	Acute: > 5,200 mg/L for 4 hours [Rat screen] - Dyspnea.
INTRAVENOUS (LD ₅₀):	Acute: 180 mg/kg [Rabbit] - Respiratory stimulation, tremors, and coma.
INTRATRACHEAL (LD ₅₀):	Acute: 800 mg/kg [Rat] - Convulsions, dyspnea, and cyanosis.
INTRATRACHEAL (LD ₅₀):	Acute: 200 mg/kg [Rabbit] - Convulsions and cyanosis.
INTRAPERITONEAL (LD ₅₀):	Acute: 6,600 mg/kg [Rabbit] - Pulmonary edema, emphysema, and changes to the bronchi.

Naphthalene:

ORAL (LD ₅₀):	Acute: 490 mg/kg [Rat].
ORAL (LD ₅₀):	Acute: 533 mg/kg [Mouse].
ORAL (LD ₅₀):	Acute: 1,200 mg/kg [Guinea Pig].
SUBCUTANEOUS (LD ₅₀):	Acute: 969 mg/kg [Mouse].
INTRAVENOUS (LD ₅₀):	Acute: 100 mg/kg [Mouse].
INTRAPERITONEAL (LD ₅₀):	Acute: 150 mg/kg [Mouse].

Biphenyl (Diphenyl or 1,1'-Biphenyl):

GAS (TCLo):	Acute: 4,400 ug/m ³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting.
ORAL (LD ₅₀):	Acute: > 2,600 mg/kg [Cat screen].
ORAL (LD ₅₀):	Acute: 2,400 mg/kg [Rat and Rabbit].
ORAL (LD ₅₀):	Acute: 1,900 mg/kg [Mouse] - Somnolence, hypermotility, and diarrhea.
DERMAL (LD ₅₀):	Acute: > 5,010 mg/kg [Rabbit screen].
INTRAVENOUS (LD ₅₀):	Acute: 56 mg/kg [Mouse].

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 650°F., commonly referred to as "middle distillates, including kerosine", have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Kerosine has not been identified as a carcinogen by IARC, NTP, or OSHA.

Kerosine produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, and the in-vitro Chinese hamster ovary (CHO) sister chromatid exchange (SCE) without activation assay; however, the in-vivo mouse SCE assay and in-vitro S9-activated CHO SCE assay produced positive responses. The significance of these animal study results to human health is unclear.

Similar materials have been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats. Also, there are additional studies with mice and rats have shown that some petroleum middle distillate fuels similar to this material have caused liver tumors and kidney damage and/or tumors. But, the kidney effects were sex hormone dependent and not seen in similar studies involving Guinea pigs, dogs, or monkeys. Also, the significance of the liver tumors in rodents is highly speculative relative to humans.

Naphthalene is a potential irritant to eyes, skin, and lungs. Following prolonged and/or repeated exposures, naphthalene has been shown to cause eye damage (cataracts and/or optical neuritis), premature destruction or red blood cells (hemolytic and aplastic anemia), and kidney damage (jaundice), and possibly neurotoxicity. Naphthalene-induced blood disorders in humans are characterized by variability in size, shape, and number of red blood cells, anemia, and decreased hemoglobin. Also, there have been reported anemia deaths amongst children exposed to moth ball (naphthalene) saturated blankets. Peripheral lens opacities occurred in eight of 21 workers exposed to elevated levels of naphthalene vapors for five years. Repeated ingestion of a naphthalene-isopropanol mixture caused tremors, restlessness, hallucinations, and extreme apprehension. Based upon animal studies, naphthalene may cause fetal toxicity or damage and decreased spleen weights in pregnant female mice.

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay of naphthalene. The study was conducted in male and female F344/N rats at exposure concentrations of 0, 10, 30, and 60 ppm. No significant effects were observed at the 10 ppm levels. However, compared to chamber controls, there was a dose-related increase in tumors generated at the 30 and 60 ppm levels in both males and females. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas, and non-neoplastic lesions of the nose were observed when compared to chamber controls. Additionally, in cytogenic tests with Chinese hamster ovary cells, naphthalene induced significant increases in sister chromatid exchanges with and without metabolic activation (S9) and chromosomal aberrations with S9. The relevance of these findings to human health is unclear; however, based upon this data, the IARC has determined naphthalene to be possibly carcinogenic to humans (Class 2B).

Atmospheric Tower Light Gas Oil (AL)

Biphenyl (Diphenyl) inhalation overexposures have caused poisoning characterized by liver atrophy and central and/or peripheral nerve damage. Biphenyl vapors have also caused transient nausea, vomiting, flaccid paralysis, and/or bronchitis.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this material, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. If present, volatile aromatic hydrocarbon components (naphthalene and biphenyl) may be released and possibly contribute to the creation of atmospheric smog.

Using Rainbow Trout (*Oncorhynchus mykiss*), Dungeness Crab (*Cancer magister*), and juvenile American Shad (*Squalus cephalus*), similar middle distillates and some of this material's components showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 20 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 200 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. When kerosene was applied to the shell surfaces of bird eggs, decreased hatchability, deformed bills and beaks, and dead embryos resulted. Based upon actual spill incident investigations, similar mixtures have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This material is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or toxic (U165) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

Atmospheric Tower Light Gas Oil (AL)

SECTION 14: TRANSPORT INFORMATION

DOT Status This material is regulated by the U.S. Department of Transportation (DOT).
Proper Shipping Name Kerosene

This material has a flash point temperature of between 100° and 141°F (38° to 60°C). For bulk shipments, it is classified as a DOT "Flammable Liquid". However, according to 49 CFR 173.120(b)(2) and 173.150(f)(1), this material may be reclassified as a "Combustible Liquid" and exempted from certain transportation-related requirements, such as labeling, when shipped in non-bulk "limited-quantity" containers of less than 119 gallons capacity. According to 49 CFR 173.150(f)(2) and (3), this provision does not apply to "limited-quantities" offered for or transported via vessel or aircraft or products which are defined as DOT "Marine Pollutants". It is recommended that "Flammable Liquid" products which are reclassified be so identified on the bill-of-lading as "Combustible liquid, n.o.s. (Kerosene) or (Decanes, Naphthalene)" with identification number "NA1993".

Hazard Class DOT Class: 3 (Flammable liquid) or Combustible liquid. **Packing Group(s)** PG III
UN/NA ID UN1223 or NA1993

Reportable Quantity A Reportable Quantity (RQ) substance component in this material which might require DOT HAZMAT bill-of-lading display is **Naphthalene**.

Placards



Emergency Response Guide No. 128

HAZMAT STCC No. 49 122 71

MARPOL III Status All impacted components were delisted as DOT "Marine Pollutants" per 66 FR 120 (page 33413) dated 6/21/2001.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.

SARA 302/304 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

SARA 311/312 The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:
Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.

SARA 313 This material contains the following components in concentrations which might be at or above de minimis levels and are listed as a "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313:
Naphthalene [CAS No. 91-20-3] concentration: 1 to 3%
Biphenyl (Diphenyl) [CAS No. 92-52-4] concentration: 1 to 3%.

CERCLA The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. A chemical substance present in this material subject to this statute is: **Naphthalene [CAS No. 91-20-3] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 3%.**

CWA This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

Atmospheric Tower Light Gas Oil (AL)

**California
Proposition 65**

This material, especially if used as a fuel, might contain detectable levels of the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it might be considered subject to requirements of California Health & Safety Code Section 25249.5: **Naphthalene [CAS No. 91-20-3] concentration: 1 to 3% and Diesel Engine Exhaust (following combustio**

**New Jersey
Right-to-Know Label**

For New Jersey labeling, refer to the components listed in Section 2.

**Additional Regulatory
Remarks**

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13): This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a from suitable for use in the household or by children. Precautionary label dialogue should display the following: **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following component of this material as "Volatile Organic Compound (VOC)" which contributes significantly to air pollution which endangers public health and welfare": **Biphenyl (Diphenyl) [CAS No. 92-52-4].**

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.0
Revision Date 10/01/2002
Print Date Printed on 10/03/2002.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Fluid Unit Fresh Feed

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0305
Revision Date 06/14/2000

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Black **Odor** Slight burnt or cracked oil

WARNING! Vapors and fumes may be hazardous or fatal!
Long-term heated storage (100° to 150°F) might evolve hydrogen sulfide, a flammable, toxic, sensitizing, and potentially deadly gas!
When heated, may cause thermal burns on contact! If hot product contacts water, a violent eruption of steam and vapor may occur!
Vapor may severely irritate the eyes and respiratory tract!
Liquid contact may cause minimal eye and/or mild to moderate skin irritation and inflammation!
Contains 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbozoles!
May cause skin cancer following extended contact!
May be harmful to target organs and/or adversely affect reproduction if absorbed through the skin! Wash thoroughly after handling.
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	0
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Fluid Unit Fresh Feed	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	3228432284	Medical Emergency	(918) 495-4700
CAS Number	Mixture—See Section 2	CHEMTREC Emergency	(800) 424-9300
Product Family	Mixture of Petroleum Hydrocarbon Medium and Heavy Distillates		
Synonyms	Fluid Catalytic Cracker Unit (FCCU) Feedstock, Cat Cracker Feedstock, Fluid Unit Fresh Feed, Medium and Heavy Vacuum Gas Oil Blend, MVGO/HVGO Mix, Intermediate and Heavy Vacuum Distillates, Vacuum Tower Sidestreams, Hydrodesulfurized Gas Oil Blend; Unfinished Heavy Oil or Bunker Fuel, 634 HDS Unit Product; 533 Crude Still Resid, C-13-C50 Petroleum Hydrocarbons		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Heavy Vacuum Gas Oil (Petroleum)	64741-57-7	0-100
2) Hydrodesulfurized Heavy Vacuum Gas Oil (Petroleum)	64742-86-5	0-100
3) Hydrodesulfurized Atmospheric Tower Residue (Petroleum)	64742-78-5	0-100
4) Intermediate Vacuum Distillate (Petroleum)	70592-76-6	0-50
5) Hydrodesulfurized Light Vacuum Gas Oil (Petroleum)	64742-87-6	0-50
6) C-13-C50 Saturated Hydrocarbons and Naphthenes	Mixture	85-95
7) Polynuclear Aromatic Hydrocarbons (4- to 6-member condensed-ring type)	68487-58-6	5-15

Fluid Unit Fresh Feed

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled ¹ . Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. Concentrations of H ₂ S at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. H ₂ S concentrations between 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, and/or low blood pressure. At greater than 500 ppm, H ₂ S causes sudden collapse, unconsciousness, and respiratory paralysis leading to convulsions, coma, and/or death. (See Section 11.)
Eye Contact	Upon direct contact, hot material may cause severe thermal burns. Animal test results on similar unheated materials suggest that this product may cause minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness. H ₂ S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).
Skin Contact	Skin contact with hot material may result in severe thermal burns. Animal test results on similar materials suggest that this material can cause mild to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage. Based upon a similar product's animal test results, a mild allergic skin response may be expected on some sensitive individuals following repeated exposures.
Ingestion	Contact with hot material may cause thermal burns. If swallowed, no significant adverse health effects are anticipated; however, this material can cause a laxative effect. Ingestion of large quantities can cause intestinal obstruction.
Chronic Health Effects Summary	This mixture's various vacuum and hydrosulfurized distillate components are heavy distillates similar to those shown to produce skin tumors and adverse effects in the liver and kidneys of laboratory animals following prolonged and repeated applications. All tumors appeared at the site of application. Toxic effects are unlikely to occur if good personal hygiene is practiced. Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing nervous system disease, cardiac or neurological conditions, skin disorders, impaired lung, liver, kidney, or spleen function, or chronic respiratory diseases should avoid exposure.
Target Organs	This substance is toxic to lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the liver, kidneys, spleen, and testes.
Carcinogenic Potential	This material is a mixture of vacuum distillates and contains polynuclear aromatic hydrocarbons at above 0.1%. It is considered carcinogenic by IARC, NTP, and OSHA. (See Section 11.)

Fluid Unit Fresh Feed

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If hot material is splashed into eyes, irrigate with large amounts of room-temperature water. Seek medical attention immediately. If ambient temperature material is splashed into eyes, check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	If burned by hot material, cool skin by quenching with large amounts of cool water. Do not remove material from the skin. Seek medical attention immediately. For contact at ambient temperatures, remove contaminated shoes and clothing. Wipe off excess material. Wash exposed skin with soap and water. If tissue appears damaged or if irritation or pain persists, apply a clean dressing and seek medical attention. Do not use ointments. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting or give anything by mouth. Rinse out mouth with water. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Do not leave victim unattended. Allow small quantities to pass through system. If large amounts are swallowed or irritation or discomfort occurs, seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. If only cough or difficulty in breathing develop, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis using pulmonary function tests and chest x-rays. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. This material may affect the hematopoietic system or cause hepatotoxicity and/or nephrotoxicity. A complete blood count, liver function tests, renal function tests and urinalysis are suggested for significant exposures. In addition, monitoring arterial blood gases is suggested for significant exposures.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IIIB Liquid. Slightly combustible!		
Flash Point Method	CLOSED CUP: AP 175°C (347°F) (Pensky-Martens Closed Cup [ASTM D-93]).		
Lower Flammable Limit	AP 0.9 to 4%	Upper Flammable Limit	AP 7 to 44%
Autoignition Temperature	AP 260° to 455°C (500° to 850°F)		
Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.		

Fluid Unit Fresh Feed**Special Properties**

This material releases vapors at or approaching its flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.

If stored under heat for extended periods or significantly agitated, this material might evolve or release **hydrogen sulfide**, a flammable gas, which can raise and widen this material's actual flammability limits and significantly lower its autoignition temperature (See Section 7)

Extinguishing Media

SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). **LARGE FIRE:** Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. **NEVER** use a water jet directly on the fire because it may spread the fire to a larger area.

Fire Fighting Protective Clothing

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat, cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Evacuate non-essential personnel and remove all ignition sources. Carefully contain spill and stop source of spill if it can be done without risk. Do not touch or walk through spilled material. Allow material to cool. Cleanup crews must wear proper heat-resistant protective clothing. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce heat or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create a fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE**Handling**

Avoid water contact or contamination, especially when heated. Do not handle hot material, if possible. Handle material as close to ambient temperatures as feasible. Avoid contact with oxidizing agents. Do not breathe vapor and avoid repeated or prolonged skin contact. Use only with adequate ventilation and personal protection. Wash thoroughly after handling. Prevent contact with food, chewing, and smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner.

Fluid Unit Fresh Feed

Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and properly labeled. Keep away from all ignition sources! Do not store with strong oxidizing agents. **Hydrogen sulfide** vapors may be evolved from long-term heated storage and/or agitated transport. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION**Engineering Controls**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

**Eye Protection**

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

WARNING! Do not use this material as a fuel without adequate ventilation. Inadequate ventilation can result in hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is not adequate to warn of hazardous conditions.

The standards for "coal tar pitch volatiles, as benzene solubles" are based upon coal coking, not upon petroleum-derived oils. However, in 29 CFR 1910.1200.1002, OSHA has defined "coal tar pitch volatiles" to include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood and other organic matter. Accordingly, the coal tar pitch volatile standard may apply to the aerosol form of this material. The "hydrogen sulfide" standards apply only to vapors evolved from long-term heated storage and/or transport.

Occupational Exposure Guidelines**Substance****Applicable Workplace Exposure Levels**

1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1999] TWA: 5 (ppm) from ACGIH (TLV) [Proposed for 2000]
2) Oil mist, mineral	TWA: 10 STEL: 15 CEIL: 20 (ppm) from (PEL) OSHA [1989] TWA: 5 STEL: 10 (mg/M ³) from ACGIH (TLV) [1999] TWA: 5 (mg/M ³) from OSHA (PEL) [1976]
3) Coal tar pitch volatiles, as benzene solubles ("A1" Confirmed Human Carcinogen)	TWA: 0.2 (mg/M ³) from ACGIH (TLV) [1999] TWA: 0.2 (mg/M ³) from OSHA (PEL) [1989]
4) Oil mist, mineral, sum total of 15 PAHs listed as carcinogens by US NTP	TWA: 0.005 (mg/M ³) from ACGIH (TLV) [Proposed for 2000.]

Fluid Unit Fresh Feed

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Black.	Odor	Slight burnt or cracked oil.
Specific Gravity	0.94 to 0.98 at 60°F (Water = 1)	pH	Not applicable	Vapor Density	GT 10 (Air = 1 at 70°F)
Boiling Point/Range	230° to 600°C (446° to 1,112°F) (ASTM D-86)	Melting/Freezing Point		24° to 49°C (75° to 120°F) (ASTM D-97)	
Vapor Pressure	LT 0.1 Reid-psia at 38°C (100°F).	Viscosity (cSt @ 40°C)		250 to 450 (ASTM D-445)	
Solubility in Water	Negligible in cold water (LT 0.001%)	Volatile Characteristics		Negligible, no Volatile Organic Compounds (VOCs) present at 438°F (225°C)	
Additional Properties	Alkane, Isoparaffin, Cycloalkane, and Naphthene Hydrocarbons Content = 85 to 95 Wt.% (ASTM D-1319); C13-C50 Aromatic Hydrocarbon Content = 5 to 15 Wt.% (ASTM D-1319); Average Density at 60°F = 7.995 lbs./gal. (ASTM D-2161); Saybolt Viscosity = 1,000 to 2,500 SUS at 100°F (ASTM D-2161); 90% Boiling Point Temperature = 1,025° to 1,075°F (552° to 580°C) (ASTM D-86); Evaporation Rate = LT 0.01 when n-Butyl acetate = 1.0				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	Composition suggests that sulfur and nitrogen compounds might be generated; but, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen sulfide.

- GAS (TCLo): Acute: 10 ppm for 15 minutes [Human] - Eye irritation.
- GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes [Human] - Respiratory irritation.
- GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death.
- GAS (LCLo): Acute: 5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death

This mixture of **vacuum distillates** has not been tested for its acute or subchronic toxicity characteristics

Laboratory data associated some **mixtures of petroleum hydrocarbons with boiling ranges between 650° and 1,100°F.**, commonly referred to as "**heavy distillates**", including all this mixture's various **vacuum and hydrodesulfurized distillate components** have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these **heavy distillates**

The International Agency for Research on Cancer (IARC) has specifically evaluated **high-boiling untreated and vacuum distillates, including these vacuum distillates**, and determined them to be carcinogenic to experimental animals, and potentially humans. Also, the National Toxicology Program (NTP), U.S. Environmental Protection Agency (EPA), and American Conference of Governmental Industrial Hygienists (ACGIH) have independently classified various **polynuclear aromatic hydrocarbon (PNA) compounds** present in this product as "confirmed human (A1), suspected human (A2), or animal carcinogens (A3)".

This material contains **polycyclic aromatic hydrocarbons (PHAs or PNAs)**, some of which have been reported to cause skin cancer on humans under conditions of poor personal hygiene, prolonged/repeated contact, and exposure to sunlight. This material may also contain **alkyl- and alkylbenzocarbozoles** which if absorbed through the skin might be responsible, in whole or part, for systemic toxicity to the liver, kidneys, spleen, and/or testes based upon limited laboratory animal studies.

Fluid Unit Fresh Feed

Untreated (straight-run) crude petroleum fractions with similar boiling point ranges produced negative mutagenic responses in the Salmonella/microsome (Ames) assay, the cell transformation assay with and without S9 activation, the in-vivo mouse sister chromatid exchange (SCE) assay, and the in-vivo rat unscheduled DNA synthesis assay; however, the unscheduled DNA synthesis in rat hepatocyte cultures assay produced mixed positive and negative responses and the in-vitro Chinese hamster ovary (CHO) SCE assay with and without S9 activation produced positive responses. The significance of these animal study results to human health is unclear.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this heavy distillate, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This material is estimated to have a slow rate of biodegradation. Based upon spill investigation analysis, oils containing **polynuclear aromatic hydrocarbon compounds** similar to this material were shown to bioaccumulate in tissues of various aquatic organisms.

Environmental Fate

This heavy distillate is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components gradually evaporating. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase slowly. This material is slowly biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment with plenty of agitation. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

Fluid Unit Fresh Feed

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is not regulated by the U S Department of Transportation (DOT).		
Proper Shipping Name	Petroleum oil, N.O.I.B N		
Hazard Class	Not a DOT controlled material	Packing Group(s)	Not applicable
		UN/NA ID	Not applicable
Reportable Quantity	Not applicable.		
Placards		Emergency Response Guide No.	Not applicable
		HAZMAT STCC No.	Not applicable.
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. A minor component substance of this material subject to the reporting requirements under this statute is: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] .
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2 This material would be classified under the following hazard categories Acute (Immediate) and Chronic (Delayed) Health Hazards.
SARA 313	This material does not contain any components in concentrations which are at or above de minimis levels and listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4 As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4 Chemical substances present in this material subject to this statute are: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] (RQ = 100 lbs. [45.36 kg]) conc.: 0.003 to 0.015% 7,12-Dimethylbenz[a]anthracene [CAS No. 57-97-6] (RQ = 1 lb. [0.4536 kg]) conc.: 0.001 to 0.003% Benzo[a]pyrene [CAS No. 50-32-8] (RQ = 1 lb. [0.4536 kg]) concentration: 0.0005 to 0.003% Benzo[b]fluoranthene [CAS No. 205-99-2] (RQ = 1 lb. [0.4536 kg]) concentration: 0.0005 to 0.002% Indeno[1,2,3-c,d]pyrene [CAS No. 193-39-5] (RQ = 100 lbs. [45.36 kg]) concentration: 0.0005 to 0.002% Hydrogen sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 0.001%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA) Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material contains low level concentrations of the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it might be subject to requirements of California Health & Safety Code Section 25249.5: Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] 5-Methylchrysene [CAS No. 3697-24-3] 7,12-Dimethylbenz[a]anthracene [CAS No. 57-97-6] Benzo[a]pyrene [CAS No. 50-32-8] Benzo[b]fluoranthene [CAS No. 205-99-2] Benzo[j]fluoranthene [CAS No. 205-82-3] Indeno[1,2,3-c,d]pyrene [CAS No. 193-39-5].

Fluid Unit Fresh Feed**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2

**Additional Regulatory
Remarks**

No additional regulatory remarks.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 06/14/2000
Print Date Printed on 06/16/2000.

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association
IARC = International Agency for Research on Cancer NTP = National Toxicology Program
NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration
NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System
NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

MATERIAL SAFETY DATA SHEET

THERMOCRACKED RESIDUE (C20+ HYDROCARBONS)

MSDS No.
R50401Rev. Date
01/29/86

ARCO PRODUCTS COMPANY
DIVISION OF ATLANTIC RICHFIELD COMPANY
1055 WEST SEVENTH STREET
LOS ANGELES, CALIFORNIA 90051

IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product

This product is considered a hazardous chemical under the OSHA Hazard Communication Rule.

I. General			
Trade Name	THERMOCRACKED RESIDUE (C20+ HYDROCARBONS)	Telephone Numbers	
Other Names	COCKER HEATER FEED	EMERGENCY 213/484-5151 LA POISON 800/424-9300 CHEMTREC CUSTOMER SERVICE 800/322-2726 INFO ONLY	
Chemical Family	PETROLEUM HYDROCARBONS	DOT Hazardous Materials Proper Shipping Name NOT DEFINED AS A "HAZARDOUS MATERIAL"	
Generic Name	THERMOCRACKED RESIDUUM (PETROLEUM)	DOT Hazard Class NOT REGULATED	
CAS No.	64741-80-6*	Company ID No.	064741806*
		UN/NA ID No.	NOT REGULATED
II. DANGER Summary of Hazards			
<p>VAPOR MAY BE HAZARDOUS OR FATAL! (SEE SECTIONS IV., VI., AND XI.) AVOID BREATHING VAPORS AND FUMES. HOT MATERIAL MAY EMIT HYDROGEN SULFIDE (H₂S), A FLAMMABLE, TOXIC, AND POTENTIALLY DEADLY GAS. POSSIBLE SKIN CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS!* MAY CAUSE IRRITATION AND/OR MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN! AVOID EYE CONTACT AND PROLONGED AND/OR REPEATED SKIN CONTACT. WASH THOROUGHLY AFTER HANDLING. MAY CAUSE THERMAL BURNS! PRODUCT IS NORMALLY HANDLED HOT (AP 100 F. TO 200 F.). WEAR PROPER PROTECTIVE CLOTHING/EQUIPMENT.</p> <p style="text-align: center;">*CONTAINS 4- TO 6-MEMBERED CONDENSED-RING AROMATIC HYDROCARBONS. (SECT. IV.)</p>			
III. Fire and Explosion			
Flash Point (Method)	Autoignition Temperature (Method)	Flammable Limits (% Vol. in Air) At Normal Atmospheric Temperature and Pressure	
GT 250° F (D-93) SEE "FIRE & EXPLOSION HAZARDS"	AP 765° F (E-659) BASED ON NFPA "FUEL OIL NO. 6"	Lower AP 1.0 Upper AP 5.0 BASED ON NFPA, "FUEL OIL NO. 6"	
Fire and Explosion Hazards	SLIGHTLY COMBUSTIBLE! OSHA/NFPA CLASS-IIIB COMBUSTIBLE LIQUID. WHEN HEATED ABOVE THE FLASH POINT, THIS PRODUCT MAY RELEASE FLAMMABLE VAPORS WHICH CAN BURN IN THE OPEN OR BE EXPLOSIVE IN CONFINED SPACES IF EXPOSED TO AN IGNITION SOURCE. MISTS OR SPRAYS MAY BE FLAMMABLE AT LOWER TEMPERATURES. TO AVOID STEAM EXPLOSION HAZARDS, DO NOT HEAT ABOVE 200° F.		
Extinguishing Media	DRY CHEMICAL, HALON, AND CARBON DIOXIDE. FOAM AND WATER FOG ARE EFFECTIVE, BUT MAY CAUSE FROTHING.		
Special Firefighting Procedures	FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER ANY ENCLOSED OR CONFINED FIRE SPACE WITHOUT PROPER PROTECTIVE EQUIPMENT. THIS MAY INCLUDE SELF-CONTAINED BREATHING APPARATUS TO PROTECT AGAINST THE HAZARDOUS EFFECTS OF COMBUSTION PRODUCTS AND OXYGEN DEFICIENCIES. COOL TANKS AND CONTAINERS EXPOSED TO FIRE WITH WATER. IMPROPER USE OF WATER AND EXTINGUISHING MEDIA CONTAINING WATER MAY CAUSE FROTHING WHICH CAN SPREAD THE FIRE OVER A LARGER AREA.		

IV. Health Hazards

Summary of Acute Hazards EYE AND SKIN BURNS CAN RESULT FROM CONTACT WITH HEATED MATERIAL. LIQUID, MIST, OR VAPOR CONTACT CAN IRRITATE EYES, SKIN, AND RESPIRATORY TRACT.

ROUTE OF EXPOSURE	SIGNS AND SYMPTOMS	Primary Route(s)
Inhalation	HYDROGEN SULFIDE GAS EVOLVED WHEN STORED/HANDLED AT ELEVATED TEMPERATURES MAY CAUSE IRRITATION AND/OR SYSTEMIC EFFECTS. DEPENDING ON EXPOSURE, LIGHT COMPONENT VAPORS MAY CAUSE SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION.	<input checked="" type="checkbox"/>
Eye Contact	N/DA BUT EYE IRRITATION MAY RESULT FROM VAPORS AND/OR LIQUID CONTACT. UPON DIRECT CONTACT, HOT MATERIAL WILL CAUSE SEVERE THERMAL BURNS. HYDROGEN SULFIDE GAS CAN CAUSE EYE IRRITATION.	<input checked="" type="checkbox"/>
Skin Absorption	N/DA BUT AFTER PROLONGED OR REPEATED CONTACT WITH LARGE AMOUNTS OF THIS MATERIAL, ABSORPTION THROUGH THE SKIN MAY OCCUR AND PRODUCE TOXIC EFFECTS.	<input type="checkbox"/>
Skin Irritation	N/DA BUT SKIN IRRITATION MAY OCCUR. MORE SERIOUS SKIN DISORDERS MAY OCCUR UPON PROLONGED OR REPEATED SKIN CONTACT. CONTACT WITH HOT MATERIAL MAY CAUSE THERMAL BURNS.	<input checked="" type="checkbox"/>
Ingestion	N/DA BUT NO SIGNIFICANT SIGNS OR SYMPTOMS INDICATIVE OF ANY ADVERSE HEALTH EFFECTS ARE EXPECTED UPON SHORT-TERM EXPOSURE.	<input type="checkbox"/>

Summary of Chronic Hazards and Special Health Effects HYDROGEN SULFIDE, AN IRRITANT GAS AT 5 PPM CONCENTRATION AND ABOVE CAN CAUSE SYSTEMIC TOXICITY. AT CONCENTRATIONS GREATER THAN 500 PPM, RAPID DEATH DUE TO RESPIRATORY PARALYSIS CAN OCCUR. MINIMIZE EMPLOYEE EXPOSURE! SIMILAR HEAVY OILS HAVE PRODUCED SKIN TUMORS ON LABORATORY ANIMALS FOLLOWING PROLONGED AND REPEATED APPLICATION. PERSONNEL WITH PRE-EXISTING SKIN DISORDERS OR CHRONIC RESPIRATORY DISEASES SHOULD AVOID EXPOSURE TO THIS PRODUCT.

V. Protective Equipment and Other Control Measures

Respiratory	FOR VAPOR/MIST CONCENTRATIONS ABOVE EXPOSURE LIMITS IN SECTION VI, USE A NIOSH/MSHA APPROVED ORGANIC VAPOR/MIST, SUPPLIED-AIR, OR SELF-CONTAINED AIR RESPIRATOR. RESPIRATOR USE SHOULD FOLLOW OSHA 29 CFR 1910.134 OR EQUIVALENT
Eye	WEAR EYE PROTECTION. IN THE LIKELIHOOD OF SPLASHING OR SPRAYING, AND ESPECIALLY IF MATERIAL IS HOT, WEAR GOGGLES AND/OR FACE SHIELD. EYE WASH WATER SHOULD BE AVAILABLE.
Skin	WHEN SKIN CONTACT IS POSSIBLE, AND ESPECIALLY WHEN HANDLING HOT MATERIAL, PROTECTIVE CLOTHING SUCH AS IMPERVIOUS HEAT-RESISTANT GLOVES, IMPERVIOUS APRON, LONG-SLEEVES, BOOTS, GOGGLES AND/OR FACE SHIELD MUST BE WORN.
Engineering Controls	USE ADEQUATE VENTILATION TO KEEP OIL MISTS/VAPORS BELOW EXPOSURE CONTROL LEVELS SHOWN IN SECTION VI. (ALSO SEE SECTION XI.) SPECIAL VENTILATION MAY BE REQUIRED FOR HANDLING CONDITIONS AT ELEVATED TEMPERATURES.
Other Hygienic and Work Practices	EMERGENCY EYE WASH FOUNTAINS AND SAFETY SHOWERS SHOULD BE AVAILABLE IN THE VICINITY OF ANY POTENTIAL EXPOSURE. OBTAIN, STUDY, AND FOLLOW RECOMMENDATIONS MADE ON MSDS CONCERNING HYDROGEN SULFIDE AND OTHER PETROLEUM RESIDUA. RESPIRATOR USE SHOULD COMPLY WITH OSHA STANDARD 29 CFR 1910.134 OR EQUIVALENT. SEE SECTION XI. FOR ADDITIONAL INFORMATION.

VI. Occupational Exposure Limits

Substance	Source	Date	Type	Value/Units	Time
HYDROGEN SULFIDE (SEE SECTION XI.)	ACGIH	1988	TWA	10 PPM	8 HRS
			STEL	15 PPM	15 MIN
PPAH (BENZENE SOLUBLES) SEE SECTION XI.	ACGIH	1988	TWA	0.2 MG/M3	8 HRS
			CTPV (BENZENE SOLUBLES) SEE SECTION XI.	OSHA	1988
OIL MIST, MINERAL (SEE SECTION XI.)	ACGIH	1988	TWA	5 MG/M3	8 HRS
			STEL	10 MG/M3	15 MIN
HYDROGEN SULFIDE	OSHA	1989	PEL	10 PPM	8 HRS
			STEL	15 PPM	15 MIN



THERMOCRACKED RESIDUE (C20+ HYDROCARBONS)

MSDS No.
RS0401
Rev. Date
01/29/86**VII. Emergency and First Aid**

Inhalation IMMEDIATELY MOVE PERSONNEL TO AREA OF FRESH AIR. FOR RESPIRATORY DISTRESS, GIVE AIR, OXYGEN, OR ADMINISTER CPR (CARDIOPULMONARY RESUSCITATION), IF NECESSARY. OBTAIN MEDICAL ATTENTION IF BREATHING DIFFICULTIES CONTINUE.

Eye Contact FLUSH EYES WITH CLEAN, LOW-PRESSURE WATER FOR AT LEAST 15 MINUTES OCCASIONALLY LIFTING THE EYELIDS. IF PAIN OR REDNESS PERSISTS AFTER FLUSHING, OBTAIN MEDICAL ATTENTION.

Skin Contact REMOVE CONTAMINATED CLOTHING. REMOVE/BRUSH EXCESS MATERIAL FROM CONTAMINATED AREA; THEN FLUSH SKIN WITH SOAP AND WATER.

Ingestion RINSE MOUTH WITH WATER. DRINK 1-2 GLASSES OF WATER OR MILK. DO NOT INDUCE VOMITING UNLESS DIRECTED BY MEDICAL PERSONNEL. OBTAIN MEDICAL ATTENTION.

Emergency Medical Treatment Procedures SEE ABOVE PROCEDURES.

VIII. Spill and Disposal

Precautions if Material is Spilled or Released CONTAIN SPILL. REMOVE ALL IGNITION SOURCES AND SAFELY STOP FLOW OF SPILL. SPILL MAY CREATE SLIPPING HAZARDS. PREVENT FROM ENTERING ALL BODIES OF WATER, IF POSSIBLE. EVACUATE ALL NON-ESSENTIAL PERSONNEL. IN URBAN AREAS, CLEANUP AS SOON AS POSSIBLE; IN NATURAL ENVIRONMENTS, CLEANUP ON ADVICE FROM ECOLOGISTS. THIS MATERIAL WILL FLOAT ON WATER. ABSORBANT MATERIAL AND PADS CAN BE USED. COMPLY WITH ALL APPLICABLE LAWS. SPILLS MAY NEED TO BE REPORTED TO THE NATIONAL RESPONSE CENTER (800/424-8802). THE SPILLED MATERIAL AND ANY WATER OR SOIL WHICH IT HAS CONTACTED MAY BE HAZARDOUS TO ANIMAL/AQUATIC LIFE.

Waste Disposal Methods MAXIMIZE PRODUCT RECOVERY FOR REUSE OR RECYCLING. CONDITIONS OF USE MAY CAUSE THIS MATERIAL TO BECOME A "HAZARDOUS WASTE" AS DEFINED BY STATE OR FEDERAL LAWS. USE APPROVED TREATMENT, TRANSPORTERS, AND DISPOSAL SITES IN COMPLIANCE WITH ALL LAWS. IF SPILL IS INTRODUCED INTO A WASTEWATER SYSTEM, THE CHEMICAL AND BIOLOGICAL OXYGEN DEMAND WILL LIKELY INCREASE. SPILL MATERIAL IS BIODEGRADABLE IF GRADUALLY EXPOSED TO MICROORGANISMS. POTENTIAL TREATMENT AND DISPOSAL METHODS INCLUDE LAND FARMING, INCINERATION, AND LAND DISPOSAL, IF PERMITTED.

IX. Components (This may not be a complete list of components)

Component Name	CAS No.	Carcinogen##	Composition amount (Vol.) (See Qualification on Page 4)
THERMAL CRACKED RESIDUUM (PETROLEUM) WHICH CONTAINS:	64741-80-6*	N/AP EQ	100 PERCENT
HYDROGEN SULFIDE (THIS MATERIAL IS LIKELY TO CONTAIN GREATER THAN 5 WEIGHT PERCENT OF 4- TO 6-MEMBERED CONDENSED-RING AROMATIC HYDROCARBONS.)	7783-06-4	N/AP LT	1 PERCENT
		N/AP	

##Listed By: 1 = NTP, 2 = IARC, 3 = OSHA, 4 = Other

Compositions given are typical values, not specifications.

X. Physical and Chemical Data

Boiling Point GT 500° F	Viscosity Units, Temp. (Method) AP 900 TO 9000 SUS AT 100° F (D2161)	Dry Point N/AP
Freezing Point N/AP	Vapor Pressure (REID-PSIA AT 100° F) LT 1.0	Volatile Characteristics SLIGHT
Specific Gravity (H₂O = 1 at 39.2° F) AP 0.95 TO 1.00	Vapor Sp. Gr. (Air = 1.0 at 60° - 90° F) AP 7	Solubility in Water NEGLIGIBLE
Hazardous Polymerization NOT EXPECTED TO OCCUR	Other Chemical Reactivity N/P	pH N/AP
Hazardous Polymerization NOT EXPECTED TO OCCUR	Other Chemical Reactivity N/P	Stability STABLE
Other Physical and Chemical Properties	BLENDED TO MEET REGULATORY & CUSTOMER REQUIREMENTS INCLUDING VISCOSITY, POUR, SULFUR, & HEAVY METALS.	
Appearance and Odor	BROWN TO BLACK-COLORED, VISCOUS LIQUID; SLIGHTLY CRACKED OR BURNT TO ASPHALTIC ODOR.	
Conditions to Avoid	EXTREME HEAT AND OPEN FLAME.	
Materials to Avoid	STRONG ACIDS, ALKALIES, AND OXIDIZERS SUCH AS LIQUID CHLORINE AND OXYGEN.	
Hazardous Decomposition Products	BURNING OR EXCESSIVE HEATING MAY PRODUCE CARBON MONOXIDE AND OTHER HARMFUL GASES/VAPORS INCLUDING OXIDES AND/OR OTHER COMPOUNDS OF SULFUR AND NITROGEN, POSSIBLY HYDROGEN SULFIDE AND METALS.	

XI. Additional Precautions

Handling, Storage and Decontamination Procedures	PARTS AND EQUIPMENT USING OR CONTAINING THIS MATERIAL SHOULD BE STEAM-CLEANED IF POSSIBLE PRIOR TO ALL MAINTENANCE PROCEDURES. ALL MATERIAL SAMPLING SHOULD BE CONDUCTED IN A MANNER WHICH AVOIDS VAPOR INHALATION OR SKIN CONTACT. HYDROGEN SULFIDE VAPORS MAY ACCUMULATE IN TANKS AND TRANSPORT COMPARTMENTS. AVOID BREATHING VAPORS WHEN OPENING HATCHES AND DOME COVERS BY STAYING UPWIND, VENTING SLOWLY, AND KEEPING YOUR FACE AWAY FROM COMPARTMENT OPENINGS. USE ONLY IN A WELL-VENTILATED AREA! HYDROGEN SULFIDE ODOR IS NOT RELIABLE AS A WARNING OF POSSIBLE OVEREXPOSURE!		
General Comments	HANDS OR OTHER POTENTIAL SKIN CONTACT AREAS SHOULD BE WASHED WITH SOAP AND WATER WHEN LEAVING WORK. WASH HANDS BEFORE EATING, DRINKING, SMOKING, OR USE OF TOILET FACILITIES. TAKE A SHOWER AFTER WORK IF GENERAL CONTACT OCCURS. REMOVE CONTAMINATED CLOTHING AND LAUNDRY BEFORE REUSE. DISCARD CONTAMINATED LEATHER GLOVES AND SHOES IF LAUNDERING IS INADEQUATE.		
General Comments	SOME OSHA PERMISSIBLE EXPOSURE LIMITS ARE NOT SHOWN IN SECTION VI BECAUSE THEY ARE LESS RESTRICTIVE THAN THE ACGIH EXPOSURE LIMITS ALREADY LISTED. SINCE SPECIFIC EXPOSURE STANDARDS/CONTROL LIMITS HAVE NOT BEEN ESTABLISHED FOR THIS MATERIAL, THE EXPOSURE LIMITS SHOWN IN SECTION VI ARE SUGGESTED AS MINIMUM CONTROL GUIDELINES. THE STANDARDS FOR PARTICULATE POLYCYCLIC AROMATIC HYDROCARBONS (PPAH) AND COAL TAR PITCH VOLATILES (CTPV) (AS BENZENE SOLUBLES) ARE BASED UPON COAL COKING, NOT UPON PETROLEUM HEAVY FUEL OILS. THESE TWO EXPOSURE LIMITS APPLY ONLY TO THE AEROSOL FORM OF THIS PRODUCT.		
General Comments	THE INFORMATION AND CONCLUSIONS HEREIN REFLECT NORMAL OPERATING CONDITIONS AND MAY BE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE MIXTURE ITSELF.		
Note	Qualifications:	EQ = Equal LT = Less Than GT = Greater Than	AP = Approximately UK = Unknown TR = Trace
			N/P = No Applicable Information Found N/AP = Not Applicable N/DA = No Data Available

Disclaimer of Liability

The information in this MSDS was obtained from sources which we believe are reliable. **HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS.**

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. **FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.**

This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable.



THERMOCRACKED RESIDUE (C20+ HYDROCARBONS)

MSDS No
RS 0401
Rev. Date
01/29/86

XII.**Regulatory Information**

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), TITLE III
SECTION 311/312 HAZARD CATEGORIES
FIRE HAZARD

SECTION 313
NO CHEMICALS IN THIS PRODUCT EXCEED THE DE MINIMUS REPORTING LEVEL ESTABLISHED BY SARA
TITLE III, SECTION 313 AND 40 CFR 372.

TOXIC SUBSTANCES CONTROL ACT (TSCA)
ALL COMPONENTS OF THIS PRODUCT ARE LISTED ON THE TSCA INVENTORY.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)
THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF CERCLA:
REPORTABLE QUANTITY (RQ), LBS
HYDROGEN SULFIDE 100#/45.4KG

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 - PROPOSITION 65
BASED ON INFORMATION CURRENTLY AVAILABLE, THIS PRODUCT IS NOT KNOWN TO CONTAIN ANY CHEMICALS
CURRENTLY LISTED AS CARCINOGENS OR REPRODUCTIVE TOXINS UNDER CALIFORNIA PROPOSITION 65 AT LEVELS
WHICH WOULD BE SUBJECT TO THE PROPOSITION. IF YOU REFORMULATE OR FURTHER PROCESS THIS PRODUCT,
YOU SHOULD FURTHER EVALUATE THIS PRODUCT BASED UPON SUCH REFORMULATION OR PROCESSING, AS WELL AS
UPON ITS FINAL COMPOSITION AND USE.



THERMOCRACKED RESIDUE (C20+ HYDROCARBONS)

MSDS No.
RS0401
Rev. Date
01/29/86

XIII. Supplement

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Vacuum Tower Bottoms (VTB)

Material Safety Data Sheet

Handwritten:
 HFR #210
 537 Crude Unit
 9 Lab
 533 Crude Unit
 536 Crude Unit

LYONDELL-CITGO Refining LP
 12000 Lawndale Avenue
 P.O. Box 2451
 Houston, TX 77252-2451

MSDS No. RS0402
 Revision Date 08/16/2001

Hazard Rankings		
	HMS	NFPA
Health Hazard	* 2	0
Fire Hazard	1	1
Reactivity	0	0

Handwritten:
 HDS-C
 * = Chronic Health Hazard
 736 Coker
 737 Coker

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Plastic semi-solid when cold; viscous liquid when hot.		
Color	Black.	Odor	Slightly burnt or cracked hydrocarbon to asphaltic. H ₂ S vapor has a rotten egg odor at low concentrations in air.

WARNING! Vapors and fumes may be hazardous or fatal!
 Long-term heated storage (100° to 150°F) might evolve hydrogen sulfide, a flammable, toxic, sensitizing, and potentially deadly gas!
 When heated, may cause thermal burns on contact! If hot product contacts water, a violent eruption of steam and vapor may occur!
 Vapor may severely irritate the eyes and respiratory tract!
 Liquid contact may cause minimal to mild eye and/or skin irritation and inflammation!
 Contains 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbozoles!
 May cause skin cancer following extended contact!
 May be harmful to target organs and/or adversely affect reproduction if absorbed through the skin! Wash thoroughly after handling.
 Spills may create a slipping hazard!

Protective Equipment

Minimum Requirements
 See Section 8 for Details

This recommendation reflects minimum PPE when product is at elevated temperatures.

SECTION 1: IDENTIFICATION

Trade Name: Vacuum Tower Bottoms (VTB)

Product Number: 064741566*

CAS Number: 64741-56-6

Product Family: Petroleum Hydrocarbon Heavy Residuum

Synonyms: Vacuum Resid; Vacuum Bottoms; Vacuum Tower Residuum from a Petroleum Crude Still; Untreated Coker Feedstock; Crude Residual Oil; Crude Resid; Bottom of the Barrel; No. 6 Fuel Oil Blending Component; Heavy Fuel Oil Blending Component; Unfinished Bunker Fuel; C34-C50+ Petroleum Hydrocarbons.

Technical Contact: *Handwritten:* Jack Clarence (800) 525-4692 or (713) 321-4269 (M-F)
 Barbara Melinda (918) 495-4700
Medical Emergency: *Handwritten:* M.O.I. (800) 424-9300
 CHEMTREC Emergency (United States Only) *Handwritten:* enaigbt2 Medical

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Vacuum Residues (Petroleum)	64741-56-6	100
2) C34-C50+ Saturated Hydrocarbons and Naphthenes	Mixture	80-95
3) Polynuclear Aromatic Hydrocarbons (4- to 6-member condensed-ring type)	68487-58-6	5-20
4) Hydrogen Sulfide	7783-06-4	0.0001-0.01

Vacuum Tower Bottoms (VTB)

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	May be harmful or fatal if inhaled! Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. Concentrations of H ₂ S at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. H ₂ S concentrations between 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, and/or low blood pressure. At greater than 500 ppm, H ₂ S causes sudden collapse, unconsciousness, and respiratory paralysis leading to convulsions, coma, and/or death. (See Section 11.)
Eye Contact	Upon direct contact, hot material may cause severe thermal burns. Animal test results on similar unheated materials suggest that this product may cause minimal eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness. H ₂ S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).
Skin Contact	<p>Skin contact with hot material may result in severe thermal burns. Animal test results on similar materials suggest that this material can cause minimal skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases.</p> <p>Prolonged and/or repeated contact may cause minimal to moderate dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage. Based upon a similar product's animal test results, a mild allergic skin response may be expected on some sensitive individuals following repeated exposures.</p>
Ingestion	Contact with hot material may cause thermal burns. If swallowed, no significant adverse health effects are anticipated; however, this material can cause a laxative effect. Ingestion of large quantities can cause intestinal obstruction.
Chronic Health Effects Summary	<p>A 104-week laboratory animal skin painting study using this vacuum residuum did NOT show a dose-related skin tumor incidence; however, this substance is similar to residual oils and heavy vacuum gas oil which did produce skin tumors and adverse effects in the liver and kidneys of laboratory animals following prolonged and repeated applications. All tumors appeared at the site of application. Toxic effects are unlikely to occur if good personal hygiene is practiced.</p> <p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.)</p>
Conditions Aggravated by Exposure	Personnel with pre-existing nervous system disease, cardiac or neurological conditions, skin disorders, impaired lung, liver, kidney, or spleen function, or chronic respiratory diseases should avoid exposure.
Target Organs	This substance may cause damage to the lungs, nervous systems, brain, mucous membranes, skin, eyes, and possibly, the liver, kidneys, spleen, and testes.
Carcinogenic Potential	This material contains 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNA) at concentrations above 0.1%. Some of these compounds has been determined to be carcinogenic by OSHA, IARC, and NTP.

Vacuum Tower Bottoms (VTB)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	If hot material is splashed into eyes, irrigate with large amounts of room-temperature water. Seek medical attention immediately. If ambient temperature material is splashed into eyes, check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	If burned by hot material, cool skin by quenching with large amounts of cool water. Do not remove material from the skin. Seek medical attention immediately. For contact at ambient temperatures, remove contaminated shoes and clothing. Wipe off excess material. Wash exposed skin with soap and water. If tissue appears damaged or if irritation or pain persist, apply a clean dressing and seek medical attention. Do not use ointments. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting or give anything by mouth. Rinse out mouth with water. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Do not leave victim unattended. Allow small quantities to pass through system. If large amounts are swallowed or irritation or discomfort occurs, seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. If only cough or difficulty in breathing develop, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis using pulmonary function tests and chest x-rays. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

This material may affect the hematopoietic system or cause hepatotoxicity and/or nephrotoxicity. A complete blood count, liver function tests, renal function tests and urinalysis are suggested for significant exposures. In addition, monitoring arterial blood gases is suggested for significant exposures.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-III B Liquid. Slightly combustible!		
Flash Point Method	190° to 232°C (375° to 450°F) (Pensky-Martens Closed Cup [ASTM D-93]).		
Lower Flammable Limit	AP 1.0%	Upper Flammable Limit	7.0 to 44%
Autoignition Temperature	260° to 455°C (500° to 850°F)		
Hazardous Combustion Products	Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.		

Vacuum Tower Bottoms (VTB)

Special Properties

This material releases vapors at or approaching its flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.

If stored under heat for extended periods or significantly agitated, this material might evolve or release **hydrogen sulfide**, a flammable gas, which can raise and widen this material's actual flammability limits and significantly lower its autoignition temperature. (See Section 7.)

Extinguishing Media

SMALL FIRE: Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas (nitrogen). **LARGE FIRE:** Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. **NEVER** use a water jet directly on the fire because it may spread the fire to a larger area.

Fire Fighting Protective Clothing

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Evacuate non-essential personnel and remove all ignition sources. Carefully contain spill and stop source of spill if it can be done without risk. Do not touch or walk through spilled material. Allow material to cool. Cleanup crews must wear proper heat-resistant protective clothing. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce heat or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create a fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

Avoid water contact or contamination, especially when heated. Do not handle hot material, if possible. Handle material as close to ambient temperatures as feasible. Avoid contact with oxidizing agents. Do not breathe vapor and avoid repeated or prolonged skin contact. Use only with adequate ventilation and personal protection. Wash thoroughly after handling. Prevent contact with food, chewing, and smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Vacuum Tower Bottoms (VTB)

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and properly labeled. Keep away from all ignition sources! Do not store with strong oxidizing agents. **Hydrogen sulfide** vapors may be evolved from long-term heated storage and/or agitated transport. H₂S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H₂S is routinely stored, install monitoring equipment or system with alarms.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor, mists, and/or fumes below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

This recommendation reflects minimum PPE when product is at elevated temperatures.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During sampling or transfer operations, especially if material is heated above 125°F (or 51°C) or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

When handling this material at elevated temperatures, use long-cuffed leather or heat-resistant gloves over chemical-resistant gloves. At ambient temperatures, use disposable nitrile, neoprene or butyl rubber gloves with repeated or prolonged use. Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with this material. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

WARNING! Do not use this material as a fuel without adequate ventilation. Inadequate ventilation can result in hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is not adequate to warn of hazardous conditions.

The standards for "coal tar pitch volatiles, as benzene solubles" are based upon coal coking, not upon petroleum-derived oils. However, in 29 CFR 1910.1200.1002, OSHA has defined "coal tar pitch volatiles" to include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood and other organic matter. Accordingly, the coal tar pitch volatile standard may apply to the aerosol form of this material. The "hydrogen sulfide" standards apply only to vapors evolved from long-term heated storage and/or transport.

Occupational Exposure Guidelines

Vacuum Tower Bottoms (VTB)

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [2001] TWA: 5 (ppm) from ACGIH (TLV) [Proposed for 2001.]
2) Oil mist, mineral	TWA: 10 STEL: 15 CEIL: 20 (ppm) from (PEL) OSHA [1989] TWA: 5 STEL: 10 (mg/M ³) from ACGIH (TLV) [2001] TWA: 5 (mg/M ³) from OSHA (PEL) [1976]
3) Coal tar pitch volatiles, as benzene solubles ("A1" Confirmed Human Carcinogen)	TWA: 0.2 (mg/M ³) from ACGIH (TLV) [2001] TWA: 0.2 (mg/M ³) from OSHA (PEL) [1989]
4) Oil mist, mineral, sum total of 15 PAHs listed as carcinogens by US NTP ("A2" Suspected Human Carcinogen)	TWA: 0.2 (mg/M ³) from ACGIH (TLV) [Proposed for 2001.]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Plastic semi-solid when cold; viscous liquid when hot.	Color Black.	Odor	Slightly burnt or cracked hydrocarbon to asphaltic. H ₂ S vapor has a rotten egg odor at low concentrations in air.
Specific Gravity	0.95 to 1.02 at 60°F (Water = 1)	pH	Not applicable.	Vapor Density >10 (Air = 1 at 70°F)
Boiling Point/Range	350° to 760°C (660° to 1,400°F) [ASTM D-86]	Melting/Freezing Point	38° to 49°C (100° to 120°F) [ASTM D-97]	
Vapor Pressure	<0.1 Reid-psia at 38°C (100°F).	Viscosity (cSt @ 40°C)	125 to 320 at 135°C [ASTM D-445]	
Solubility in Water	Negligible in cold water (<0.001%).	Volatile Characteristics	Negligible; no Volatile Organic Compounds (VOCs) present at 500°F (260°C).	
Additional Properties	Average Calculated Density at 60°F = 8.210 lbs./gallon; Saybolt Viscosity = 900 to 1,500 SUS at 275°F [ASTM D-2161]; Evaporation Rate =<0.005 when n-Butyl acetate = 1.0.			

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids and alkalis, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	Composition suggests that sulfur and nitrogen compounds might be generated; but, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	The American Petroleum Institute (API) sponsored a battery of laboratory tests to determine the acute toxicity characteristics of Vacuum Residues (Petroleum) . It was shown to be a minimal skin irritant and minimal to mild eye irritant in rabbits and non-sensitizing to the skin of Guinea pigs. A rabbit skin painting study at 3 doses of 2,000 mg/kg per week for 4 weeks showed mild to moderate irritation, white discharges from the treated sites, and decreased food intake. A 104-week mouse skin-painting study produced a negative dose-related tumor response and mutagenicity studies showed negative responses in the modified Ames assay, in-vivo rat bone marrow assay, and in-vitro mouse lymphoma cell assay without S9 activation. The in-vitro mouse lymphoma cell assay with S9 activation showed a weakly positive result.
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Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 650° and 1,100°F., commonly referred to as "heavy distillates", including vacuum residuum have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these heavy distillates.

Vacuum Tower Bottoms (VTB)

The International Agency for Research on Cancer (IARC) has not specifically evaluated **vacuum residues**; however, IARC has determined that **high-boiling untreated and vacuum distillates, including heavy vacuum gas oil** are carcinogenic to experimental animals, and potentially humans. Also, the National Toxicology Program (NTP), U.S. Environmental Protection Agency (EPA), and American Conference of Governmental Industrial Hygienists (ACGIH) have independently classified various **polynuclear aromatic hydrocarbon (PNA) compounds** present in this product as "confirmed human (A1), suspected human (A2), or animal carcinogens (A3)".

This material contains **polycyclic aromatic hydrocarbons (PHAs or PNAs)** some of which have been reported to cause skin cancer on humans under conditions of poor personal hygiene, prolonged/repeated contact, and exposure to sunlight. This material may also contain **alkyl- and alkylbenzocarbozoles** which if absorbed through the skin might be responsible, in whole or part, for systemic toxicity to the liver, kidneys, spleen, and/or testes based upon limited laboratory animal studies.

Hydrogen sulfide:

- GAS (TCLo): Acute: 10 ppm for 15 minutes [Human] - Eye irritation.
- GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes [Human] - Respiratory irritation.
- GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death.
- GAS (LCLo): Acute: 5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, this heavy residuum, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This material is estimated to have a very slow rate of biodegradation. Based upon spill investigation analysis, oils containing **polynuclear aromatic hydrocarbon compounds** similar to this material were shown to bioaccumulate in tissues of various aquatic organisms at 1 to 100 ppm levels.

Environmental Fate

This heavy residuum is potentially toxic to freshwater and saltwater ecosystems. It may or may not float on water. In stagnant or slow-flowing waterways, a hydrocarbon oil layer may cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Vacuum Tower Bottoms (VTB)

**California
Proposition 65**

This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.

**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2.

**Additional Regulatory
Remarks**

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. A chemical substance present in this material which is subject to this statute is: **Hydrogen Sulfide**.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
 Revision Date 08/16/2001
 Print Date Printed on 08/16/2001.

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists				AIHA = American Industrial Hygiene Association		
IARC = International Agency for Research on Cancer				NTP = National Toxicology Program		
NIOSH = National Institute of Occupational Safety and Health				OSHA = Occupational Safety and Health Administration		
NPCA = National Paint and Coating Manufacturers Association				HMIS = Hazardous Materials Information System		
NFPA = National Fire Protection Association				EPA = Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

Material Safety Data Sheet

MSDS No
RS0405

Atmospheric Tower Bottoms

HMIS	IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product.	Protective Equipment						
<table border="1"> <tr> <td>Health Hazard</td> <td>*3</td> </tr> <tr> <td>Fire Hazard</td> <td>1</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> </table> <p>* = Chronic Health Hazard</p>	Health Hazard	*3	Fire Hazard	1	Reactivity	0	<p>This product is covered by the OSHA Hazard Communication Standard and this document has been prepared in accord with the MSDS requirements of the rule.</p>	
Health Hazard	*3							
Fire Hazard	1							
Reactivity	0							

SECTION 1: IDENTIFICATION

Trade Name	Atmospheric Tower Bottoms	MSDS No.	RS0405
Product Number	064741453*	Revision Date	7/24/97
CAS Number	64741-45-3*		
Synonyms	Atmospheric Tower Residuum, Atmospheric Residuum, Crude Tower Bottoms, Crude Residuum		
Generic Name	Atmospheric Tower Residuum (Petroleum)		
Chemical Family	C20-C50 Petroleum Hydrocarbons		
Manufacturer	LYONDELL-CITGO Refining Company Ltd. 12000 Lawndale Avenue P O Box 2451 Houston, Texas 77252-2451	Telephone Numbers	800/424-9300 CHEMTREC 800/313-7645 Company Hot Line 713/321-4215 MSDS Requests

SECTION 2: COMPOSITION

Component Name	CAS Number	Carcinogenic Listings	Concentration Wt%
ATMOSPHERIC TOWER RESIDUUM (PETROLEUM) WHICH CONTAINS 4-6 FUSED-RING POLYNUCLEAR AROMATIC HYDROCARBONS (PNAs) HYDROGEN SULFIDE (H ₂ S)	64741-45-3 NA 68487-58-6 7783-06-4	Not applicable NA IARC, NTP, OSHA, EPA Not applicable	EQ 100 NA AP 5 to 25 0 001 to 0 01

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Signal Word	WARNING!	Color	Black
Physical State	Plastic semi-solid when cold, viscous liquid when hot	Odor	Slightly burnt or cracked hydrocarbon to asphaltic Hydrogen sulfide vapor has a rotten egg odor at low concentrations in air
Physical and Health Hazards	When heated, may cause thermal burns on contact! Long-term heated storage (100° to 150°F) might evolve hydrogen sulfide (H ₂ S), a flammable, poisonous gas! If hot product contacts water, a violent eruption of steam and vapor may occur! Mist or vapor may irritate the eyes and respiratory tract! Liquid contact may cause minimal to mild eye and skin irritation and inflammation! Contains 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbazoles! May cause skin cancer following prolonged and/or repeated contact! May be harmful to target organs and/or adversely affect reproduction if absorbed through the skin! Spills may create a slipping hazard!		
Environmental Hazards	Ecological effects testing has not been conducted on this product. However, if spilled, this product, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life.		

POTENTIAL HEALTH EFFECTS

Routes of Exposure	Inhalation, Skin and eye contact, Skin Absorption
Signs and Symptoms of Acute Exposure	
• Inhalation	Breathing heated mist or vapor may irritate the mucous membranes of the nose, throat, bronchi, and lungs. Hydrogen sulfide (H ₂ S) gas evolved from this material while stored or handled at elevated temperatures may be harmful or fatal if inhaled. Concentrations of H ₂ S at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. H ₂ S concentrations between 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, low blood pressure, and/or coma. Greater than 500 ppm H ₂ S may cause sudden collapse, respiratory paralysis, convulsions, and death.
• Eye Contact	Upon direct contact, hot material may cause severe thermal burns. Unheated material may cause minimal to mild eye irritation. H ₂ S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).
• Skin Contact	Based upon animal test results, minimal to mild skin irritation and inflammation is expected from short-term exposure. Animal studies have also shown that target organ effects may be caused by prolonged or repeated contact and/or skin absorption. (See the "Inhalation" above, "Chronic Health Effects Summary" below, and Section 11.)
• Ingestion	Ingestion is highly unlikely. If swallowed, no significant adverse health effects are expected to occur from short-term exposure, however, it might cause a laxative effect. Contact with hot material may cause thermal burns.
Chronic Health Effects Summary	Prolonged and/or repeated contact may produce mild to moderate skin irritation and inflammation. Also, oils similar to this product have been shown to be mutagenic, induce skin tumors, and cause adverse effects in the liver, kidneys, thymus, adrenal glands, bone marrow, testes, and embryo/fetus of laboratory animals following prolonged and repeated application. Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing eye or skin disorders, chronic respiratory diseases, central nervous system (CNS) disease, cardiac or neurological conditions, impaired pulmonary, cardiovascular, liver, kidney, thymus, bone marrow function, anemia, red blood cell abnormalities, or immune system deficiencies should avoid exposure.
Target Organs	Eyes, skin, mucous membranes, respiratory system, lungs, central nervous system, heart, liver, kidneys, bone marrow, blood, thymus, adrenal gland and/or immune system, and possibly the reproductive systems or unborn embryo/fetus.
Carcinogenic Potential	Please refer to Sections 2 and/or 11 for the identification of components, if any, which have been identified as having carcinogenic potential in animals and/or humans.

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS.

Inhalation	Move the exposed person to fresh air at once. If breathing has stopped, initiate artificial respiration, if the heart has stopped, initiate CPR. When breathing is difficult, properly trained personnel may administer 100% oxygen. Keep the affected person warm and at rest. Get medical attention as soon as possible.
Eye Contact	Check for and remove contact lenses. Immediately wash the eyes with large amounts of clean low-pressure water, occasionally lifting the upper and lower lids. If irritation persists, promptly seek medical attention.
Skin Contact	If hot oil contacts the skin, immediately flush with large amounts of water to cool the affected tissue, obtain medical treatment immediately. Otherwise, promptly remove excess oil and contaminated clothing, wash the contaminated area thoroughly with a waterless cleanser followed by mild soap and water. If irritation occurs after washing, seek medical attention. Thoroughly clean contaminated clothing before reuse, discard contaminated leather goods.
Ingestion	Ingestion is not expected to cause harm. However, if more than a half-cup full of this material is swallowed and patient is conscious, give quantities of water, and obtain medical attention. Do not induce vomiting.
Notes to Physician	Treat symptomatically. Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal.

SECTION 5: FIRE FIGHTING MEASURES**FLAMMABLE PROPERTIES**

Flammability Classification	Slightly Combustible ¹ OSHA/NFPA Class-III-B Combustible Liquid
Flash Point/Method	AP 450° to 550°F (232° to 288°C) by ASTM D-93
Flammable Limits %	LEL: AP 1.0% UEL: AP 7.0% (At or approaching the Flash Point)
Auto-Ignition Temperature	AP 950°F (510°C) (Estimated)
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, aldehydes, and other harmful gases/vapors including oxides and/or other compounds of sulfur and nitrogen, possibly hydrogen sulfide, alkyl mercaptans, and some heavy metals
Special Properties	When heated above its flash point temperature, this material will release flammable vapors which, if exposed to an ignition source, can burn in the open or be explosive in confined spaces. Mists or sprays may be flammable at temperatures below the flash point

EXTINGUISHING MEDIA

Small Fire Use dry chemicals, carbon dioxide (CO₂), foam, water fog, or inert gas
 Large Fire Use foam, water fog, or waterspray. Water fog and spray are effective but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.

FIRE FIGHTING

Protective Equipment/Clothing: Wear a NIOSH-approved positive pressure self-contained breathing apparatus and firefighter's turnout gear

Instructions: Evacuate area and fight from a maximum distance or use unmanned hose holders or monitor nozzles. Disperse vapors with water spray, cover pooling liquid with foam. Containers can build up pressure if exposed to heat, cool with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of vessel.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview in Section 3 and Exposure Controls in Section 8 of this MSDS.

Contain spill and prevent it from entering all bodies of water, if possible. Safely stop flow of spill. Evacuate non-essential personnel from immediate area due to slipping hazard.

Maximize product recovery for reuse or recycling. Absorb spill with inert material (e.g., dry sand, earth, or other non-combustible absorbents) and place in a chemical waste container for later disposal. In urban areas, cleanup spill as soon as possible; in natural environments, cleanup on advice from ecologists. This material will float on water. Absorbent pads and similar materials can be used. Comply with all laws and regulations.

SECTION 7: HANDLING and STORAGE**Handling**

Remove spillage immediately from hard, smooth walking areas. Avoid oxidizing agents and ignition sources. Avoid contact with eyes, skin, and clothing. Avoid breathing of mist or vapor. Use only with adequate ventilation and personal protection. Wash thoroughly after handling. Prevent contact with food, chewing, or smoking materials.

Water contamination should be avoided and minimum feasible handling temperatures should be maintained. Periods of exposure to high temperatures (GT 200°F) should be minimized.

Parts and equipment using or containing this product must be steam-cleaned prior to all maintenance procedures. All material sampling should be conducted in a manner which avoids vapor inhalation or skin contact. Use of good personal hygiene practices by maintenance personnel is required.

Storage

Keep containers tightly closed. DO NOT puncture or incinerate containers.

Hydrogen sulfide's (rotten egg) odor is not a reliable warning of possible overexposure! Sampling, transportation, and shipping personnel should use extreme caution when opening a sealed container or entering confined areas using heated storage. H₂S vapors may accumulate in tanks, sump pits, and transport compartments. Avoid breathing vapors when opening hatches and dome covers by staying upwind, venting slowly, and keeping your face away from compartment openings. Proper respiratory equipment should be used when entering any area where these vapors are being emitted.

Hydrogen sulfide is very corrosive to all electro-chemical series metals. It can cause pipes and valves to corrode and become blistered, pitted and brittle. Lines and fittings likely to contain H₂S should be inspected frequently and receive special attention, monitoring, and maintenance to prevent leaks. Metal components used in H₂S service should be resistant to sulfide stress cracking.

SECTION 8: EXPOSURE CONTROLS and PERSONAL PROTECTION**ENGINEERING CONTROLS**

Engineering controls are normally required when handling hot material. Use process enclosures, local exhaust ventilation, or other controls to maintain airborne levels below recommended exposure limits. Engineering controls should meet applicable requirements of the National Electrical Code. Storage or handling facilities should be equipped with an emergency eyewash station and safety shower.

PERSONAL PROTECTIVE EQUIPMENT**• Protective Equipment****• Eye Protection**

If sampling or working with heated material, especially if material is heated above 125°F (or 51°C), a full-face supplied-air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Otherwise, safety glasses should be adequate protection under most other conditions of use.

• Skin Protection**- Hands**

Use disposable vinyl, nitrile, neoprene, butyl, latex, PVC/nitrile, or PVC/NBR gloves. When handling hot materials, use leather gloves over chemically-resistant gloves.

- Body

Avoid skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek® or neoprene) should be worn. This might include apron, slicker suit, boots, and additional facial protection.

• Respiratory Protection

For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the exposure guidelines, a full-face supplied-air respirator with escape bottle or a positive-pressure, pressure-demand, SCBA is required. Respirator use should follow OSHA requirements 29 CFR 1910.134 or equivalent (e.g. ANSI Z88.2).

• *General Comments*

Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, solvents, or harsh abrasive skin cleaners.

Since specific exposure standards/control limits have not been established for this product, the "oil mist, mineral" exposure limits shown below are suggested as minimum control guidelines. The standards for "coal tar pitch volatiles (CTPV), as benzene solubles" are based upon coal coking, not upon petroleum-derived, high-boiling fraction oils. These exposure limits apply only to the aerosol form of this product. The "hydrogen sulfide" standards apply only to vapors evolved from long-term heated storage and/or handling.

EXPOSURE GUIDELINES

Substance	Source	Date	Type	Value	Time
HYDROGEN SULFIDE	OSHA	1989	PEL	10 ppm	8 Hours
HYDROGEN SULFIDE	OSHA	1989	STEL	15 ppm	15 Mins
HYDROGEN SULFIDE	OSHA	1989	CEILING	20 ppm	NA
HYDROGEN SULFIDE	ACGIH	1996	TLV	10 ppm	8 Hours
HYDROGEN SULFIDE	ACGIH	1996	STEL	15 ppm	15 Mins
OIL MIST, MINERAL	OSHA	1989	PEL	5 mg/M3	8 Hours
OIL MIST, UNREFINED MINERAL (Proposed)	ACGIH	1995	TLV	0.2 mg/M3	8 Hours
COAL TAR PITCH VOLATILES, AS BENZENE SOLUBLES	OSHA	1989	PEL	0.2 mg/M3	8 Hours
COAL TAR PITCH VOLATILES, AS BENZENE SOLUBLES	ACGIH	1996	TLV	0.2 mg/M3	8 Hours

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Plastic semi-solid when cold, viscous liquid when hot		
Color	Black		
Odor	Slightly burnt or cracked hydrocarbon to asphaltic Hydrogen sulfide vapor has a rotten egg odor at low concentrations in air		
pH	Not applicable		
Vapor Pressure	LT 0.1 mm of Hg at 70°F	Viscosity	AP 900 to 5,000 SUS at 100°F (ASTM D-2161)
Vapor Specific Gravity	GT 10 when Air = 1.0 at 70°F	Melting/Freezing Pt.	AP 100°F (38°C) (ASTM D-97)
Volatile Characteristics	Negligible	Solubility in Water	Negligible
Boiling Point/Range	660° to AP 1,400°F (350° to 760°C)(ASTM D-86)	Specific Gravity	AP 0.94 to 0.99 (ASTM D-1250)
Additional Properties	Average Calculated Density = AP 8.080 lbs/gal, Kinematic Viscosity = AP 195 to 1,080 cSt at 40°C (ASTM D-445), Sulfur Content = AP 1.0 to 4.0 Wt % (ASTM D-2622)		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable
Conditions to Avoid	Extreme heat, open flame, and strong agitation or stirring
Incompatibility with Other Materials	Strong acids, alkalis, and oxidizers such as liquid chlorine and oxygen. Hydrogen sulfide is dangerously reactive with strong oxidizing materials (nitric acid, chlorine, fluorine, etc.), some metals, metal oxides, and metal powders. H ₂ S is corrosive to some metals and alloys, especially those containing copper and/or tungsten.
Hazardous Decomposition Products	No degradation data available. Free aromatic amines may be released in a reducing environment.
Hazardous Polymerization	Not expected to occur.

SECTION 11: TOXICOLOGICAL INFORMATION**Vacuum Residuum (a similar material)**

ORAL (LD50)	Acute	GT 5,000 mg/kg (Rat screen level) - Hypoactivity, diarrhea, and dark-stained anal region
DERMAL (LD50)	Acute	GT 2,000 mg/kg (Rabbit screen level)
DRAIZE EYE	Acute	Minimal irritant (Rabbit)
DRAIZE DERMAL	Acute	Minimal irritant (Rabbit)
BUEHLER DERMAL	Acute	Non-sensitizing (Guinea Pig)
28-Day DERMAL	Sub-Chronic	Mild skin irritant at highest dose (Rabbit)
104-Week DERMAL	Chronic	No dose-related skin tumors at site of application (Mouse)
MUTAGENICITY		
in-vitro Lymphoma Assay		Negative without S9 activation and weakly positive with S9 activation (Mouse)

The International Agency for Research on Cancer (IARC) has not specifically evaluated atmospheric tower residuum, however, similar residual fuel oils, high-boiling catalytic cracked oils, and heavy vacuum gas oil have been determined to be carcinogenic to experimental animals. IARC has also determined that there is inadequate evidence for the carcinogenicity of heavy fuel oils or on humans.

The National Toxicology Program (NTP), U.S. Environmental Protection Agency (EPA), and American Conference of Governmental Industrial Hygienists (ACGIH) have independently classified various polynuclear aromatic hydrocarbon (PNA) compounds present in this product as "confirmed human, suspected human, or animal carcinogens".

Catalytic Cracked Clarified Oil (a similar material)

ORAL (LD50)	Acute	5,270 mg/kg (Rat males) & 4,320 mg/kg (Rat females) - Somnolence, diarrhea, hypermotility, ataxia, prostration, lacrimation, eye opacity, piloerection, and hair loss
DERMAL (LD50)	Acute	GT 2,000 mg/kg (Rabbit screen level)
DRAIZE EYE	Acute	Mild eye irritant (Rabbit)
DRAIZE DERMAL	Acute	Minimal to mild skin irritant (Rabbit)
BUEHLER DERMAL	Acute	Non-sensitizing (Guinea Pig)
I/P DERMAL	Acute	Tumor initiator & possibly promoter activity (Mouse)
28-Day DERMAL	Sub-chronic	0% Mortality at 200, 10% at 400, 40% at 1,000, & 100% at 2,000 & 4,000 mg/kg/day (Rat & Rabbit) - Edema, skin ulceration, and depression. Minimal to moderate diffuse hepatocytomegaly in all animals at 400 mg/kg/day, slight skin hyperplasia and hyperkeratosis. Liver, thymus, & testes damage and increased liver- to-body weight ratios at 400 & 1,000 mg/kg/day. Studies at 2,000 & 4,000 mg/kg/day were terminated on day 11 due to early deaths.
12-Week DERMAL	Sub-chronic	5% Mortality at 40, 35% at 200, & 100% at 400 mg/kg/ day (Rat) - Hepatocellular necrosis and generalized systemic toxicity
52-Week DERMAL	Chronic	5 uL/kg 2x/week (Mouse) - Significant increase in contact- point skin tumors with 22-week mean latency, increased liver and liver-to-body weight ratios, & decreased survivability (87% mortality)
104-Week DERMAL	Chronic	0.5 uL/kg 2x/week (Mouse) - 90% of the animals had contact-point skin tumors with 72-week mean latency
MUTAGENICITY Many different in-vivo and in-vitro mutagenic assays have shown "positive" responses with or without S9 metabolic activation. The only "negative" mutagenic responses were when using the Mouse Cell Transformation Assay without S9 activation, the in-vitro Chinese Hamster Ovary Cell Assay, and the in-vivo Mouse Bone Marrow Assay.		
TERATOGENESIS		
in-vitro Ovarian Tumor Attachment Inhibition Assay		Suspect teratogen (rating 3) (Mouse)
Embryonic Palatal HEPM Cell Growth Inhibition Assay		Suspect teratogen (rating 3) with and without S9 metabolic activation (Human)

Hydrogen Sulfide (H₂S):

GAS (TELo)	Acute	AP 1 ppm (Human) - Odor response threshold
GAS (TCLo)	Acute	AP 10 ppm (Human) (15 minutes) - Eye irritation
GAS (TCLo)	Acute	50 to 100 ppm (Human) (15 minutes) - Respiratory irritation
GAS (LCLo)	Acute	600 ppm (Human) (30 minutes) - Unconsciousness, respiratory paralysis, and death
GAS (LC100)	Acute	600 to 750 ppm (Human) (15 minutes) - Unconsciousness, respiratory paralysis, and death
GAS (LCLo)	Acute	5,700 ug/kg (Human) - Chronic pulmonary

			edema, coma, and death
GAS	(LCLo)	Acute	800 ppm (Rat) (5 minutes)
GAS	(LC50)	Acute	635 ppm (Mouse) (1 hour)
GAS	(LC50)	Acute	445 ppm (Rat) (4 hours) - Hypermotility, diarrhea, and increased urine volume
5-Day GAS	Sub-chronic	1,200 mg/M3 (Rat) (2 hours/day)	- Decreased cholinesterase and degenerative brain changes
35-Day GAS	Sub-chronic	100 ppm (Rat) (8 hours/day)	- Decreased cytochrome oxidases and degenerative brain and pulmonary effects
90-Day GAS	Sub-chronic	80 ppm (Rat & Mouse) (6 hours/day)	- Decreased brain weight and weight loss or decreased weight gain
TERATOGENESIS	Sub-chronic	20 ppm for 24 hours on days 6 thru 22 of pregnancy (Rat)	- Developmental physical effects

OTHER REPRODUCTIVE EFFECTS One unconfirmed study mentions H₂S as causing damage to the human testes and/or male reproduction. Recent studies do not confirm this association. Other studies mention increased risk of miscarriage, abortion, and difficulties during pregnancy and labor, but these studies involved mixed chemical exposures and/or physical confounders such as lifting heavy weights.

SECTION 12: ECOLOGICAL INFORMATION

Ecological effects testing has not been conducted on this product. However, if spilled, this product, its storage tank, water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This product's coating action can also be harmful or fatal to aquatic life and waterfowl.

This product is estimated to have a slow (LT 20 vol %) rate of biodegradation. Based upon actual spill investigations, heavy aromatic oils similar to this product were shown to bioaccumulate in tissues of various aquatic animals at 1 to 100 ppm levels.

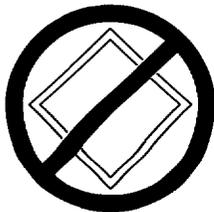
SECTION 13: DISPOSAL CONSIDERATIONS

Conditions of use may cause this material to become a "hazardous waste", as defined by state or federal laws. Use approved storage, treatment, transporters, and disposal sites in compliance with all applicable regulations. If this material is introduced into a wastewater treatment system, chemical and biological oxygen demand will likely increase slowly. It is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment with plenty of agitation. Potential treatment and disposal methods include land farming and incineration.

SECTION 14: TRANSPORT INFORMATION

DOT Status	Not a U.S. Department of Transportation regulated material		
Proper Shipping Name	Not regulated		
Hazard Class	Not regulated		
UN/NA ID	Not applicable	Packing Group(s)	Not applicable
Reportable Quantity	RQ (HYDROGEN SULFIDE)		

Placards



Emergency Response Guide Number	Not applicable
HAZMAT STCC Number	Not applicable
MARPOL III Status	Not a "Marine Pollutant"

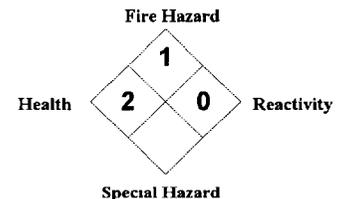
SECTION 15: REGULATORY INFORMATION

TSCA	All components of this product are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning and notification based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) listed in 40 CFR 302.4 and 40 CFR 355. Components present in this product which are subject to the reporting requirements under this statute are: HYDROGEN SULFIDE (CAS No. 7783-06-4)
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Immediate (Acute) and Delayed (Chronic) Health Hazards.
SARA 313	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of an annual Toxic Chemical Release Inventory Report (Form R) by facilities which receive, import, make, process, or otherwise use "Toxic Chemicals" above specified threshold quantities. These facilities must also notify their customers if a product contains "Toxic Chemicals" regulated under 40 CFR 372.65. This information must also be included in all MSDS's that are copied and distributed for the product. This product contains no known chemical substances subject to this statute which exceed de minimus levels.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "Hazardous Substances" equal to or greater than the "Reportable Quantities (RQs)" listed in 40 CFR 302.4. Components present in this product which are subject to the reporting requirements under this statute are: HYDROGEN SULFIDE RQ: 100 Pounds (45.4 Kg)
California Proposition 65	The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) requires warning be given for ingredients known to the State of California to cause cancer, birth defects, or other reproductive toxicity. Minor components of this product which require warnings are: BENZO[a]PHENANTHRENE (CHRYSENE) (CAS No. 218-01-9) 7,12-DIMETHYLBENZO[a]ANTHRACENE (CAS No. 57-97-6) INDENO[1,2,3-c,d]PYRENE (CAS No. 193-39-5) 5-METHYLCHRYSENE (CAS No. 3697-24-3).
Additional Regulatory Remarks	This product is classified as an oil under Section 311 of the Clean Water Act (40 CFR 110) and the Oil Pollution Act of 1990 (40 CFR 112). Discharge or spills which produce a visible sheen on either navigable surface water, or in waterways and sewers which lead to navigable surface water, must be reported to the National Response Center (800-424-8802).

SECTION 16: OTHER INFORMATION**HMIS (U.S.A.)**

Health Hazard	*3
Fire Hazard	1
Reactivity	0

* = Chronic Health Hazard

National Fire Protection Association (U.S.A.)**REVISION INFORMATION**

Version Number	02
Revision Date	7/24/97
Latest Revision	MSDS updated and converted to ANSI 16-section format on 7/24/97
Print Date	Printed on 9/30/98

ABBREVIATIONS

AP = Approximately EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data

ACGIH = American Conference of Governmental Industrial Hygienists

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCT FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

MATERIAL SAFETY DATA SHEET

MAIN FRACTIONATOR FEED - FCCU

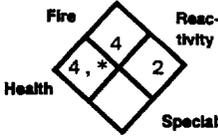
MSDS No.
RS 501

Rev. Date
09/01/89

LYONDELL-CITGO REFINING COMPANY, LTD.
12000 LAWDALE AVENUE
P. O. BOX 2451
HOUSTON, TEXAS 77252-2451

IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product.

This product is considered a hazardous chemical under the OSHA Hazard Communication Rule.

I. General		
Trade Name	MAIN FRACTIONATOR FEED - FCCU	Telephone Numbers EMERGENCY 800/424-9300 CHEMTREC 800/525-4692 HOT LINE CUSTOMER SERVICE 713/475-4215 INFO ONLY
Other Names	REACTOR OVERHEAD - FLUID CATALYTIC CRACKER UNIT	
Chemical Family	PETROLEUM HYDROCARBONS	DOT Hazardous Materials Proper Shipping Name PETROLEUM DISTILLATE, N.O.S.
Generic Name	FLUID FRACTIONATOR FEED STOCK	DOT Hazard Class 3 (FLAMMABLE LIQUID)
CAS No.	SEE SECTION IX	Company ID No. 1111111130 UN/NA ID No. UN 1268
II. DANGER Summary of Hazards		
<p>EXTREMELY FLAMMABLE ! KEEP AWAY FROM HEAT, SPARKS AND OPEN FLAME. MAY CAUSE EYE IRRITATION ! AVOID CONTACT WITH LIQUID AND/OR VAPORS. IF SWALLOWED, DO NOT INDUCE VOMITING SINCE ASPIRATION INTO THE LUNGS MAY CAUSE THERMAL PNEUMONIA. OBTAIN PROMPT MEDICAL ATTENTION. MAY CONTAIN HYDROGEN SULFIDE (H2S) A FLAMMABLE, TOXIC AND POTENTIALLY DEADLY GAS. VAPORS MAY PRODUCE CENTRAL NERVOUS SYSTEM DEPRESSION. SEE SECTION IV.</p> <p>MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN. PROLONGED AND REPEATED SKIN CONTACT MAY CREATE CANCER RISK, ORGAN DAMAGE, AND ADVERSELY AFFECT FETAL DEVELOPMENT AND FETAL SURVIVAL.</p> <p>*CONTAINS 4 TO 6-MEMBER CONDENSED-RING AROMATIC HYDROCARBONS. (SEE SECT. IV)</p>		
III. Fire and Explosion		
Flash Point (Method)	Autoignition Temperature (Method)	Flammable Limits (% Vol. in Air) At Normal Atmospheric Temperature and Pressure
AP -75° F (EST.) SEE "FIRE & EXPLOSION HAZARDS"	AP 500° F (EST.) BASED ON NFPA "BUTANE"	Lower AP 1.6 Upper AP 8.4 BASED ON NFPA "BUTANE"
Fire and Explosion Hazards	EXTREMELY FLAMMABLE! THIS MATERIAL RELEASES VAPORS AT OR BELOW AMBIENT TEMPERATURES. WHEN MIXED WITH AIR IN CERTAIN PROPORTIONS AND EXPOSED TO AN IGNITION SOURCE, THESE VAPORS CAN BURN IN THE OPEN OR EXPLODE IN CONFINED SPACES. BEING HEAVIER THAN AIR, FLAMMABLE VAPORS MAY TRAVEL LONG DISTANCES ALONG THE GROUND BEFORE REACHING A POINT OF IGNITION AND FLASHING BACK.	
Extinguishing Media	DRY CHEMICAL, HALON, AND CARBON DIOXIDE. FOAM AND WATER FOG ARE EFFECTIVE BUT MAY CAUSE FROTHING.	<p>HAZARD RATING:</p> <p>4 - Extreme 3 - High 2 - Moderate 1 - Slight 0 - Insignificant</p> <div style="display: flex; align-items: center; justify-content: center;">  </div> <p>* Chronic Health Hazard - See Section IV.</p>
Special Firefighting Procedures	FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER ANY ENCLOSED OR CONFINED FIRE SPACE WITHOUT PROPER PROTECTIVE EQUIPMENT. THIS MAY INCLUDE SELF-CONTAINED BREATHING APPARATUS TO PROTECT AGAINST THE HAZARDOUS EFFECTS OF COMBUSTION PRODUCTS AND OXYGEN DEFICIENCIES. COOL TANKS AND CONTAINERS EXPOSED TO FIRE WITH WATER.	

IV. Health Hazards					
Summary of Acute Hazards	LIQUID, MIST, OR VAPORS MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION. ASPIRATION INTO THE LUNGS WILL CAUSE CHEMICAL PNEUMONIA.				
ROUTE OF EXPOSURE	SIGNS AND SYMPTOMS Primary Route(s)				
Inhalation	MAY CONTAIN H ₂ S A TOXIC AND POTENTIALLY DEADLY GAS. VAPORS AND/OR MIST MAY PRODUCE CNS DEPRESSION, HEADACHE, FATIGUE, DIZZINESS, UNCONSCIOUSNESS, CONVULSIONS AND DEATH DEPENDING ON CONCENTRATION AND DURATION OF EXPOSURE. <input checked="" type="checkbox"/>				
Eye Contact	TESTS ON SIMILAR MATERIALS INDICATED THAT EYE IRRITATION MAY RESULT FROM CONTACT WITH LIQUID, MIST, AND/OR VAPORS. HYDROGEN SULFIDE IS AN EYE IRRITANT. <input checked="" type="checkbox"/>				
Skin Absorption	TESTS ON SIMILAR MATERIALS HAVE SHOWN THAT AFTER PROLONGED OR REPEATED SKIN CONTACT, ABSORPTION THROUGH THE SKIN MAY OCCUR PRODUCING TOXIC EFFECTS (SEE SUMMARY OF CHRONIC HAZARDS). <input checked="" type="checkbox"/>				
Skin Irritation	SKIN IRRITATION MAY OCCUR. MORE SERIOUS SKIN DISORDERS MAY OCCUR UPON PROLONGED OR REPEATED SKIN CONTACT. (SEE THE "SUMMARY OF CHRONIC HAZARDS AND SPECIAL HEALTH EFFECTS" BOX BELOW.) <input checked="" type="checkbox"/>				
Ingestion	THIS MATERIAL MAY INDUCE NAUSEA, VOMITING, DIARRHEA AND RESTLESSNESS AFTER INGESTION. <input type="checkbox"/>				
Summary of Chronic Hazards and Special Health Effects	AFTER REPEATED AND PROLONGED SKIN EXPOSURE, TESTS ON SIMILAR MATERIALS HAVE PRODUCED SKIN TUMORS AND ADVERSE EFFECTS IN THE LIVER, KIDNEYS, THYMUS, BONE MARROW, BLOOD, SPLEEN, LYMPH NODES AND REPRODUCTIVE ORGANS. THIS MATERIAL APPLIED TO THE SKIN OF PREGNANT RATS OVER TWENTY DAYS PRODUCED MATERNAL AND FETAL TOXICITY AND MALFORMATIONS. PERSONNEL WITH PRE-EXISTING SKIN DISORDERS OR CHRONIC RESPIRATORY DISEASES SHOULD AVOID EXPOSURE TO THIS PRODUCT.				
V. Protective Equipment and Other Control Measures					
Respiratory	FOR EXCESSIVE GAS CONCENTRATIONS, USE ONLY NIOSH/MSHA-APPROVED, SELF-CONTAINED BREATHING APPARATUS. (SEE "OTHER HYGIENE AND WORK PRACTICES" BELOW, AND SECTION XI.)				
Eye	INCREASE PROTECTION BEYOND THE NORMAL USE OF SAFETY GLASSES BY WEARING GOGGLES OR FACE SHIELD. CONTACT LENSES SHOULD NOT BE WORN. AN EYE WASH FOUNTAIN SHOULD BE AVAILABLE IN THE VICINITY OF USE.				
Skin	AVOID ALL SKIN CONTACT, WEAR OIL IMPERVIOUS (EG: NITRILE) CLOTHING AND GLOVES. IF SKIN CONTACT OCCURS, IMMEDIATELY USE WATERLESS HAND CLEANER, DRY WIPE, THEN FLUSH AREA WITH SOAP AND WATER.				
Engineering Controls	USE ADEQUATE VENTILATION TO KEEP VAPOR AND MIST CONCENTRATIONS OF THIS MATERIAL BELOW THE OCCUPATIONAL EXPOSURE LIMITS SHOWN IN SECTIONS VI. & XI. ELECTRICAL EQUIPMENT SHOULD FOLLOW NATIONAL ELECTRICAL CODE (NEC) STANDARDS				
Other Hygienic and Work Practices	USE GOOD PERSONAL HYGIENE. IN CASE OF SKIN CONTACT, WASH WITH MILD SOAP AND WATER OR A WATERLESS HAND CLEANER. IMMEDIATELY REMOVE SOILED CLOTHING AND WASH THOROUGHLY BEFORE REUSE. CLEAN OR DISCARD SOAKED LEATHER GOODS. PERSONNEL SHOULD NOT ENTER AREAS WHERE THE ATMOSPHERE IS BELOW 19.5 VOL.% OXYGEN WITHOUT SPECIAL PROCEDURES/EQUIPMENT. RESPIRATOR USE SHOULD COMPLY WITH OSHA 29 CFR 1910.134 OR EQUIVALENT. (SEE SECTION XI.-GENERAL COMMENTS)				
VI. Occupational Exposure Limits					
Substance	Source	Date	Type	Value/Units	Time
PPAH (TYPE A1A CARCINOGEN).	ACGIH	1989	TWA	0.2 MG/M3	8 HRS
HYDROGEN - SIMPLE ASPHYXIANT	ACGIH	1989			
HYDROGEN SULFIDE	ACGIH	1989	TWA	10 PPM	8 HRS
			STEL	15 PPM	15 MIN

MAIN FRACTIONATOR FEED - FCCU

MSDS No.
RS 501
Rev. Date
09/01/89

VII. Emergency and First Aid			
Inhalation	IMMEDIATELY MOVE PERSONNEL TO AREA OF FRESH AIR. FOR RESPIRATORY DISTRESS, GIVE AIR, OXYGEN, OR ADMINISTER CPR (CARDIOPULMONARY RESUSCITATION), IF NECESSARY. OBTAIN MEDICAL ATTENTION IF BREATHING DIFFICULTIES CONTINUE.		
Eye Contact	FLUSH EYES WITH CLEAN, LOW-PRESSURE WATER FOR AT LEAST 15 MINUTES. OCCASIONALLY LIFTING THE EYELIDS. IF PAIN OR REDNESS PERSISTS AFTER FLUSHING, OBTAIN MEDICAL ATTENTION.		
Skin Contact	REMOVE CONTAMINATED CLOTHING. REMOVE/BRUSH EXCESS MATERIAL FROM CONTAMINATED AREA; THEN FLUSH SKIN WITH SOAP AND WATER.		
Ingestion	RINSE MOUTH WITH WATER. DRINK 1-2 GLASSES OF WATER OR MILK. DO NOT INDUCE VOMITING UNLESS DIRECTED BY MEDICAL PERSONNEL. OBTAIN MEDICAL ATTENTION.		
Emergency Medical Treatment Procedures	DELAYED SKIN REACTION MAY OCCUR TO AFFECTED SKIN AREAS WITH SUBSEQUENT EXPOSURE TO SUN LIGHT OR ULTRAVIOLET LIGHT (PHOTOSENSITIZATION). IF THIS DEVELOPS, SEEK MEDICAL ATTENTION.		
VIII. Spill and Disposal			
Precautions if Material is Spilled or Released	CONTAIN SPILL. REMOVE ALL IGNITION SOURCES AND SAFELY STOP FLOW OF SPILL. SPILL MAY CREATE SLIPPING HAZARDS. PREVENT FROM ENTERING ALL BODIES OF WATER, IF POSSIBLE. EVACUATE ALL NON-ESSENTIAL PERSONNEL. IN URBAN AREAS, CLEANUP AS SOON AS POSSIBLE; IN NATURAL ENVIRONMENTS, CLEANUP ON ADVICE FROM ECOLOGISTS. THIS MATERIAL WILL FLOAT ON WATER. ABSORBENT MATERIAL AND PADS CAN BE USED. COMPLY WITH ALL APPLICABLE LAWS. SPILLS MAY NEED TO BE REPORTED TO THE NATIONAL RESPONSE CENTER (800/424-8802). THE SPILLED MATERIAL AND ANY WATER OR SOIL WHICH IT HAS CONTACTED MAY BE HAZARDOUS TO ANIMAL/AQUATIC LIFE.		
Waste Disposal Methods	MAXIMIZE PRODUCT RECOVERY FOR REUSE OR RECYCLING. DISPOSE OF PRODUCT AND CONTAMINATED MATERIAL AS EPA "IGNITABLE HAZARDOUS WASTE" (D001), UNLESS PROVEN OTHERWISE. USE APPROVED TREATMENT, TRANSPORTERS AND DISPOSAL SITES IN COMPLIANCE WITH ALL LAWS. IF SPILL IS INTRODUCED INTO A WASTEWATER SYSTEM, THE CHEMICAL AND BIOLOGICAL OXYGEN DEMAND WILL LIKELY INCREASE. SPILL MATERIAL IS BIODEGRADABLE IF GRADUALLY EXPOSED TO MICRO-ORGANISMS. A POTENTIAL DISPOSAL METHOD IS INCINERATION.		
IX. Components <small>(This may not be a complete list of components)</small>			
Component Name	CAS No.	Carcinogen##	Composition amount (Vol.) (See Qualification on Page 4)
LIGHT CATALYTIC CRACKED NAPHTHA (PETROLEUM)	64741-55-5*	N/AP AP	25 TO 30 PERCENT
HEAVY CATALYTIC CRACKED NAPHTHA (PETROLEUM)	64741-54-4*	N/AP AP	25 TO 30 PERCENT
LIGHT CATALYTIC CRACKED DISTILLATE (PETROLEUM)	64741-59-9*	N/AP AP	20 TO 25 PERCENT
C1-C3 HYDROCARBONS	68527-16-2*	N/AP LT	15 PERCENT
C4 HYDROCARBONS	68527-19-5*	N/AP AP	10 PERCENT
HYDROGEN	1333-74-0	N/AP LT	5 PERCENT
CATALYTIC CRACKED CLARIFIED OIL (PETROLEUM)	64741-62-4*	,2, ,4 LT	5 PERCENT
BENZENE	71-43-2	1,2,3,4 LT	5 PERCENT
HEAVY CATALYTIC CRACKED DISTILLATE (PETROLEUM)	64741-61-3*	,2, ,4 LT	2 PERCENT
HYDROGEN SULFIDE	7783-06-4	N/AP LT	1 PERCENT
##Listed By: 1 = NTP, 2 = IARC, 3 = OSHA, 4 = Other		Compositions given are typical values, not specifications.	

X. Physical and Chemical Data			
Boiling Point AP -70° TO 1000° F		Viscosity Units, Temp. (Method) AP 35 SUS AT 100° F (D2161)	
Freezing Point N/DA		Vapor Pressure N/DA	
Specific Gravity (H ₂ O = 1 at 39.2° F) N/D		Vapor Sp. Gr. (Air = 1.0 at 60°-90° F) AP 7	Solubility in Water NEGLIGIBLE
Hazardous Polymerization NOT EXPECTED TO OCCUR		Other Chemical Reactivity N/P	
Dry Point N/AP			
Volatile Characteristics APPRECIABLE			
pH N/AP			
Stability STABLE			
Other Physical and Chemical Properties N/P			
Appearance and Odor DARK COLORED LIQUID			
Conditions to Avoid HEAT AND IGNITION SOURCES.			
Materials to Avoid STRONG ACIDS, ALKALIES, AND OXIDIZERS SUCH AS LIQUID CHLORINE AND OXYGEN.			
Hazardous Decomposition Products BURNING OR EXCESSIVE HEATING MAY PRODUCE CARBON MONOXIDE AND OTHER HARMFUL GASES/VAPORS INCLUDING OXIDES AND/OR OTHER COMPOUNDS OF SULFUR AND NITROGEN.			
XI. Additional Precautions			
<p>Handling, Storage, and Decontamination Procedures</p> <p>STORE AND TRANSPORT IN ACCORDANCE WITH ALL APPLICABLE LAWS. KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME! KEEP CONTAINERS CLOSED AND PLAINLY LABELED! GROUND ALL DRUMS AND TRANSFER VESSELS WHEN HANDLING. USE ONLY WITH ADEQUATE VENTILATION! AVOID BREATHING VAPORS. STORE SAMPLES IN A COOL (LT. 80° F.) WELL VENTILATED PLACE. THIS STORAGE AREA AND VENTILATION EQUIPMENT SHOULD COMPLY WITH NFPA STANDARDS CLASS-IA/B FLAMMABLE LIQUIDS AND NEC REQUIREMENT.</p>			
<p>General Comments</p> <p>H₂S ODOR IS UNRELIABLE AS A WARNING OF POSSIBLE OVEREXPOSURE. MAY CONTAIN BENZENE WHICH MAY PRODUCE ANEMIA OR MORE SERIOUS BLOOD DISORDERS INCLUDING LEUKEMIA. THE RISK OF BENZENE-INDUCED BLOOD DISORDERS FROM THIS MATERIAL IS NOT KNOWN. SOME PETROLEUM NAPHTHAS, ESPECIALLY ALKYLATES, HAVE BEEN SHOWN TO PRODUCE KIDNEY DAMAGE IN MALE RATS AND SKIN TUMORS ON MICE. THE IMPLICATIONS OF THESE DATA FOR HUMAN HEALTH EFFECTS IS NOT KNOWN.</p> <p>SINCE SPECIFIC EXPOSURE STANDARDS/CONTROL LIMITS HAVE NOT BEEN ESTABLISHED FOR THIS MATERIAL, THE EXPOSURE LIMITS SHOWN IN SECTION IV. ARE SUGGESTED AS MINIMAL CONTROL GUIDELINES. THE STANDARDS FOR PARTICULATE POLYCYCLIC AROMATIC HYDROCARBONS (PPAH) AND COAL TAR PITCH VOLATILES (CTPV) (AS BENZENE SOLUBLES) ARE BASED UPON COAL COKING NOT ON PETROLEUM HEAVY FRACTIONS. THESE TWO EXPOSURE LIMITS APPLY ONLY TO THE AEROSOL FORM OF THIS MATERIAL.</p> <p>THE INFORMATION AND CONCLUSIONS HEREIN REFLECT NORMAL OPERATING CONDITIONS AND MAY BE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE MIXTURE ITSELF.</p>			
<p>--- Note --- Qualifications: EQ = Equal AP = Approximately N/P = No Applicable Information Found LT = Less Than UK = Unknown N/AP = Not Applicable GT = Greater Than TR = Trace N/DA = No Data Available</p>			
<p align="center">Disclaimer of Liability</p> <p>The information in this MSDS was obtained from sources which we believe are reliable. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS.</p> <p>The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.</p> <p>This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable.</p>			

XII.**Regulatory Information****SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), TITLE III**

SECTION 311/312 HAZARD CATEGORIES

IMMEDIATE (ACUTE) HEALTH HAZARD
FIRE HAZARD

DELAYED (CHRONIC) HEALTH HAZARD

SECTION 313

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA
TITLE III, SECTION 313 AND 40 CFR 372:

BENZENE

TOXIC SUBSTANCES CONTROL ACT (TSCA)

ALL COMPONENTS OF THIS PRODUCT ARE LISTED ON THE TSCA INVENTORY.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)

THIS PRODUCT CONTAINS THE FOLLOWING CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF CERCLA:

BENZENE
HYDROGEN SULFIDE**REPORTABLE QUANTITY (RQ), LBS**10#/4.54KG
100#/45.4KG**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 - PROPOSITION 65**THIS PRODUCT CONTAINS THE FOLLOWING CHEMICAL(S) LISTED BY THE STATE OF CALIFORNIA AS "KNOWN TO
THE STATE TO CAUSE CANCER":

BENZENE

XIII

Supplement



Stripped Sour Water

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0904
Revision Date 11/04/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid.		
Color	Water white, yellow, brown, or black.	Odor	Odorless to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal.

DANGER! Contains Bound Hydrogen Sulfide (H₂S) and Ammonia (NH₃)! Flammable and toxic vapor may be released if mixture is subjected to high heat or hot surfaces, contact with acids, or severe agitation! Concentrated vapor may cause flash fire or explosion! May react with acids, acidic solutions, or halogenated materials! Reactions may generate extremely flammable hydrogen (H₂) gas! May be harmful or fatal if inhaled or ingested! High concentrations of vapor reduce oxygen available for breathing and may cause nervous system depression or paralysis and suffocation! Eye and/or skin irritation may result from vapor or liquid contact! Spills may create a slipping hazard!

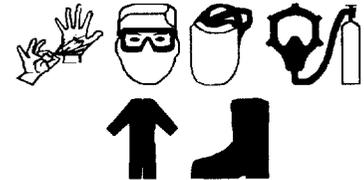
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Stripped Sour Water	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111111140	Medical Emergency	(918) 495-4700
CAS Number	Mixture---See Section 2	CHEMTREC Emergency	(800) 424-9300
Product Family	Decontaminated process water.		
Synonyms	Aqueous Solution Containing Low Concentrations of Hydrogen Sulfide and Ammonia; Stripped Condensate Water; H ₂ S/NH ₃ -Stripped Wastewater; Effluent from the Sour Water Stripper Tower		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Water	7732-18-5	99.95-100
2) Hydrogen sulfide	7783-06-4	0-0.03
3) Ammonia	7664-41-7	0-0.02

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye contact Inhalation Skin Absorption Ingestion

Signs and Symptoms of Acute Exposure

Stripped Sour Water

Inhalation	Inhalation is not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of mist or liquid droplets may cause respiratory tract irritation, mucous membrane tissue burns, and possibly, pulmonary edema and chemical pneumonia. Generated vapor may be harmful or fatal if inhaled! Inhalation of the released vapor may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Ammonia vapors may cause severe lung effects which might be delayed in onset. Symptoms are characterized by coughing, choking, or shortness of breath. NIOSH has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H ₂ S cause unconsciousness and respiratory paralysis leading to coma and/or death. Also, NIOSH has determined that atmospheres containing 300 ppm or more of ammonia (NH₃) are immediately dangerous to life and health. (See Section 11.)
Eye Contact	Direct liquid contact may cause eye irritation upon short-term exposure and can produce severe, and possibly permanent, tissue damage if not promptly removed. The severity of the effects depend on the concentration of the ammonia component and how soon after exposure the eyes are washed. Generated vapor may cause severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and ammonia and duration of exposure.
Skin Contact	May be moderately to severely irritating to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solutions (LT 0.04 wt % ammonia). Prolonged or repeated contact, even to dilute concentrations of ammonia solutions , may cause some degree of permanent tissue destruction. Hydrogen sulfide can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.
Ingestion	Ingestion is unlikely. However, if swallowed, this material may cause gastrointestinal tract irritation, nausea, and vomiting, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon the ammonia concentration, ulceration of the gastrointestinal tract may also occur.
Chronic Health Effects Summary	Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. Chronic dyspnea, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several workers two years after their occupational overexposures to mists or aerosols of ammonia . Also, when ingested by rats, aqueous ammonia solutions have been shown to cause gastrointestinal tract tumors. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing eye, skin, or gastrointestinal disorders, nervous system diseases, impaired kidney function, or chronic respiratory diseases neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material's components. They should take additional precautions to minimize or avoid vapor exposure.
Target Organs	Components of this mixture are potentially toxic to eyes, skin, mucous membranes, lungs, nervous systems, brain, kidneys, and possibly the blood, heart, and/or the endocrine and reproductive systems.
Carcinogenic Potential	This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP. (See Section 11.)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Stripped Sour Water

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with water under a cool or cold shower for at least 15 minutes while removing contaminated shoes and clothing. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases, and groin area. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.
Notes to Physician	<p>If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a dilute solution of boric acid or acetic acid.</p> <p>Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Stripped sour water is non-flammable under normal conditions of use, however, if improperly handled, generated H ₂ S or H ₂ vapors are Extremely Flammable!		
Flash Point/Method	Not applicable or AP -73°C (-100°F) for H ₂ S		
Lower Flammable Limit	Not applicable or AP 4.0% for H ₂ S.	Upper Flammable Limit	Not applicable or 45% for H ₂ S.
Auto-Ignition Temp.	Not applicable or AP 260°C (500°F) for H ₂ S		
Hazardous Combustion Products	Contact with some metals might generate extremely flammable hydrogen (H ₂) gas. This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Special Properties	High heat, hot surface contact, or mixing with acids may spring steam, extremely flammable H ₂ S, and/or toxic NH ₃ vapors out of this solution. H ₂ S is heavier than air and may travel long distances along the ground to an ignition source and flash back. It may also create a vapor/air explosion hazard in confined spaces such as in sewers. Adding this mixture directly to unbuffered water may cause a slightly exothermic reaction.		
Extinguishing Media	Non-combustible, if handled and stored properly. Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.		
Fire Fighting Protective Clothing	This material is not expected to burn. However, in the event that gases are being generated or surrounding materials are involved in a fire, firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.		

Stripped Sour Water

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Avoid contact with damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. For large spills, dike far ahead of spill to maximize later product recovery or disposal. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and proper protective clothing during cleanup operations. This material may react strongly with acids. Never flush to the sewer. In urban areas, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists to minimize physical habitat damage. If appropriate, neutralize with a dilute solution of boric acid or acetic acid. A vacuum truck may be used to collect the bulk. Spills on other than pavement may be handled by removing the affected soil and placing it into approved containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE**Handling**

Do not breathe mist or vapor. Do not get in eyes, on skin, or on clothing. Wear suitable personal protective equipment to prevent eye and skin contact. Wash thoroughly after handling.

Danger! Irritating Liquid and/or Poisonous and Flammable Gas! Do NOT breathe mist or vapor; it may contain hydrogen sulfide (H₂S), and/or ammonia (NH₃). Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow material to contact eyes, skin or other tissues, and clothing. Wear corrosion-resistant protective work clothing and chemical splash goggles and face shield when contact is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for H₂S concentrations and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable, corrosive, and/or poisonous residue.

Storage

Store in containers appropriate for dilute ammonia solutions and away from acids. Diluted material may accelerate corrosion of metal containers.

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room. The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION**Engineering Controls**

No special ventilation is required under normal conditions of use. Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Where hydrogen sulfide and/or ammonia may be generated, special ventilation will be required. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Stripped Sour Water

Eye Protection	Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Thermal protection should be provided if the solution has a temperature above 120 degrees F. Suitable eye wash water should be readily available.
Hand Protection	Avoid skin contact. Use of chemical-resistant gloves (e.g., PVC, neoprene, rubber, or vinyl) is required. Thermal protection should be used whenever the solution has a temperature above 120 degrees F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.
Body Protection	Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (e.g., vinyl, Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. Thermal protection should be provided when the solution has a temperature above 120 degrees F. If general contact occurs, IMMEDIATELY remove soaked clothing and shower thoroughly. Contaminated leather goods should be removed immediately and discarded.
Respiratory Protection	Misting or vapor generation is not expected under normal conditions of use; so respiratory protection is not anticipated under normal use conditions and with adequate ventilation. However, when anticipated or if generated hydrogen sulfide or ammonia are present at concentrations above applicable workplace exposure levels, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g. ANSI Z88.2).
General Comments	Releases of residual hydrogen sulfide and/or ammonia may create flammable, explosive, toxic, and/or oxygen-deficient atmospheres (LT 19.5 Vol.% in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency and hydrogen sulfide. Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners. Exposure standards/control limits for some of the components apply to airborne concentrations of dust, and are not truly applicable to liquid solutions. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1999] TWA: 5 (ppm) from ACGIH (TLV) [2000]
2) Ammonia	TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) [1989] TWA: 25 STEL: 35 (ppm) from ACGIH (TLV) [1999] STEL: 35 (ppm) from OSHA (PEL) [1989] TWA: 50 STEL: 35 (ppm) from OSHA (PEL) [1976]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Water white, yellow, brown, or black.	Odor	Odorless to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal.
Specific Gravity	1.00 to 1.02 (Water = 1)	pH	7.0 to 9.0 [Moderately Basic.]	Vapor Density	0.59 to 1.18
Boiling Point/Range	-79° to 100°C (-110° to 212°F) at 14.7 psia	Melting/Freezing Point			-129° to 0°C (-200° to 32°F) at 14.7 psia.
Vapor Pressure	212 to 394 psia at 100°F (based upon H ₂ S and NH ₃)	Viscosity (cSt @ 40°C)			Not applicable
Solubility in Water	Completely soluble in cold water; but may cause an exothermic reaction.	Volatile Characteristics			Negligible volatility in proper storage.
Additional Properties	A 0.02% solution of ammonia has about an 8.0 pH. Ammonia has a vapor density lighter than air and will disperse rapidly, however, hydrogen sulfide has a vapor density heavier than air and will tend to accumulate in low places or travel along the ground creating a flashback fire hazard.				

Stripped Sour Water

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from strong acids, heat and hot surfaces, strong oxidizing conditions, and severe agitation Contact with some metals can generate extremely flammable hydrogen (H ₂) gas Avoid direct contact with organic halogen compounds.		
Materials Incompatibility	Strong acids, halogenated compounds, and some heavy metals. Ammonia solutions are corrosive to chromium and silver and alloys containing these metals and will react violently with their powdered forms.		
Hazardous Decomposition Products	Free aromatic amines may be released in a reducing environment.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen sulfide

GAS (TCLo): Acute: 10 ppm for 15 minutes [Human] - Eye irritation.

GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes [Human] - Respiratory irritation.

GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death.

GAS (LCLo): Acute: 5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death

Ammonia:

ORAL (LDLo) Acute: 132 mg/kg [Human].

ORAL (TDLo) Acute: 15 uL/kg [Human] - Structural changes in the esophagus.

GAS (TCLo): Acute: 20 ppm for 1hour [Human] - Eye irritation, ulcerated nasal septum, and structural changes in the trachea or bronchi.

GAS (LCLo) Acute: 5,000 ppm for 5 minutes [Human].

GAS (LCLo): Acute: 5,000 ppm for 5 minutes [Guinea Pig]

GAS (LC₅₀): Acute: 2,000 ppm for 4 hours [Rat].

GAS (LC₅₀): Acute: 7,000 mg/m³ for 1 hour [Cat and Rabbit] - Excitement and flaccid paralysis without anesthesia.

GAS (LC₅₀): Acute: 4,230 ppm for 1 hour [Mouse] - Ataxia, tremors, and convulsions.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Ammonia is a strong base and forms **ammonium hydroxide** upon contact with water. This material is corrosive to many organic compounds. If ingested, ammonia can cause severe pain, bloody diarrhea, cardiovascular collapse, and death. Concentrated ammonia is a strong corrosive which can cause burns of the following types: cryogenic from contact with refrigerated liquid, thermal from exothermic reaction with water, and chemical from its alkalinity. It gelatinizes the tissue, forming deep and painful lesions. At low concentrations, aqueous ammonia is a moderate to strong irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. Its effects on the lungs can be severe and delayed in onset; respiratory support may be required following acute inhalation. However, there seems to be a wide variability in the human sensitivity to ammonia.

Chronic dyspnea, restrictive lung dysfunction, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several employees two years after their occupational overexposures to mists and aerosols of **ammonia**. An **aqueous ammonia solution** caused gastrointestinal cicatricial tumors in rats following a 24-week feeding assay. NH₃ produced a positive mutagenic response in the Ames Assay and caused chromosomal aberrations during a 16-week cytogenic study using rats. However, in general, pH alterations produce false positive results in short-term genetic assays.

Stripped Sour Water**SECTION 12: ECOLOGICAL INFORMATION**

Ecotoxicity	Ecological effects testing has not been conducted on this material. Vapor releases from this material are expected to cause significant immediate impact but only localized non-persistent environmental damage. Due caution should be exercised to prevent an accidental release into the environment. Volatile components may contribute to smog formation
Environmental Fate	This material is wastewater and is expected to readily disperse in marine environments. Caustic solutions have produced slight to moderate toxicity in laboratory tests with aquatic organisms. It is expected to be slightly alkaline. If released to surface water, it may cause a pH rise depending upon the buffering capacity of the waterbody. Aquatic organisms become increasingly stressed as pH concentration exceeds 9.0, with many species being intolerant of pH of 10.0 or higher. The dilute nature of this mixture precludes any significant impact on large water bodies. Substances in this mixture do not bioaccumulate. For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Maximize component recovery prior for reuse or recycling. Potential treatment and disposal methods include steam stripping, bio-oxidation, incineration, and land disposal, if permitted. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Toxic liquid, flammable, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Ammonia)		
Hazard Class	DOT CLASS: 6.1 (Poison B).	Packing Group(s)	PG III
		UN/NA ID	UN1992
Reportable Quantity	A Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are Hydroxide sulfide and Ammonia .		
Placards			Emergency Response Guide No. 131
		HAZMAT STCC No.	49 203 78
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material contains detectable concentrations of the following chemical substances subject to this statute. Hydrogen sulfide [CAS No. 7783-06-4] and Ammonia [CAS No. 7664-41-7] .

Stripped Sour Water

SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) & Chronic (Delayed) Health, Sudden Release of Pressure, and Fire Hazards.
SARA 313	This material does not contain any components in concentrations which are at or above de minimis levels and are listed as a toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Hydroxide sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.4 kg]) concentration: 0 to 0.03% Ammonia [CAS No. 7664-41-7] (RQ = 100 lbs. [45.4 kg]) concentration: 0 to 0.02%
CWA	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. A chemical substance present in this material which is subject to this statute is: Hydroxide sulfide [CAS No. 7783-06-4].

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2 0
Revision Date 11/04/1999
Print Date Printed on 02/16/2000.

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Oily Wastewater

Material Safety Data Sheet

RS0911
HFR# 200
533 crude
732 FCCU
DOCKS
WBE TANK

SRU
HAZCOM
MAINT-2

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0911
Revision Date 3/18/2004

Hazard Rankings

	HMIS	NFPA
Health Hazard	2	1
Fire Hazard	0	0
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.

Color Transparent, white to grey color. **Odor** Hydrocarbon.

WARNING:

NON-POTABLE WATER.

Do not use for Drinking, Washing or Cooking.

Process water may be hot and can cause thermal burns.

Process Water may contain toxic gases and flammable hydrocarbons. Check vapor spaces of vessels and storage tanks for flammable vapors and toxic gases prior to commencing hot work or confined space entry.

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Oily Wastewater	Technical Contact	(800) 525-4692
Product Number	RS0911	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Refinery Intermediate Stream		
Synonyms	Contaminated Process Water; Oil-contaminated Water; Wastewaters from Refinery Process Areas; Wastewaters containing Benzene and Aromatics; Water, C6-C50 Hydrocarbons, Hydrogen Sulfide, and Ammonia Mixture.		

SECTION 2. COMPOSITION (TYPICAL)

Component Name(s)	CAS Registry No.	Concentration (%)
Oily Wastewater	Mixture	100

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

Oily Wastewater

Inhalation	Depending upon the source of the process water, volatile hydrocarbons may be liberated from this material. Signs and symptoms of exposure include respiratory irritation, excitation or giddiness, headache, nausea, vomiting and similar effects of central nervous system depression. This material may liberate hydrogen sulfide. Symptoms of hydrogen sulfide exposure marked by an initial foul rotten egg odor include irritation of eyes and respiratory tract. At high levels, hydrogen sulfide paralyzes the respiratory system, leading to death by asphyxiation. Odor cannot be relied upon to warn of the continuous presence of hydrogen sulfide.
Eye Contact	This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Effects may become more serious with repeated or prolonged contact.
Skin Contact	May cause mild skin irritation with redness and/or an itching or burning feeling. Effects may become more serious with repeated or prolonged contact.
Ingestion	Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea.
Chronic Health Effects Summary	No chronic health effects anticipated. See toxicological Information (section 11)
Conditions Aggravated by Exposure	Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin
Target Organs	May cause damage to the following organs: skin, eye, lens or cornea.
Carcinogenic Potential	This product is not known to contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification			OSHA Physical Hazard Classification						
Irritant	<input type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. Keep the affected individual warm and at rest.
Eye Contact	Check for and remove contact lenses. Flush eyes with cool, clean, low-pressure water for at least 15 minutes while occasionally lifting and lowering eyelids. Do not use eye ointment unless directed to by a physician. Seek medical attention if excessive tearing, irritation, or pain persists.
Skin Contact	If burned by hot material, cool skin by quenching with large amounts of cool water. For contact with product at ambient temperatures, remove contaminated shoes and clothing. Wipe off excess material. Wash exposed skin with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods. If material is injected under the skin, seek medical attention immediately.

Oily Wastewater

Ingestion	Do not induce vomiting unless directed to by a physician. Do not give anything to drink unless directed to by a physician. Never give anything by mouth to a person who is not fully conscious. Seek medical attention immediately.
Notes to Physician	Treat symptomatically.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Not applicable.	
Flash Point	Not applicable.	
Lower Flammable Limit	Not determined.	Upper Flammable Limit Not determined.
Autoignition Temperature	Not applicable.	
Hazardous Combustion Products	Aqueous phase does not support combustion. Burning of oil layer (if any) will liberate carbon dioxide, carbon monoxide, smoke, fumes, and/or unburned hydrocarbons.	
Special Properties	This material is not expected to burn nor support combustion. The vapor spaces of storage tanks containing petroleum contact water may contain flammable vapor. Always check for flammable vapors prior to performing any hot work on these structures.	
Extinguishing Media	Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.	
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.	

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Stop leak if you can do so without risk. For small spills, absorb or cover with dry earth, sand, or other inert non-combustible absorbent material and place into waste containers for later disposal. Contain large spills to maximize recovery or disposal. Avoid entry into waterways or uncontrolled storm sewers. In natural environments, seek cleanup advice from specialists to minimize physical habitat damage. This material is miscible in water. For oil sheen, absorbent pads and similar materials can be used.

SECTION 7. HANDLING AND STORAGE

Handling	Avoid contact with eyes, skin, and clothing. Avoid breathing mist or vapor. Use only with adequate ventilation and personal protective equipment. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.
Storage	Do not store with strong acids or water reactive materials. Do not store in open or unlabeled containers.

Oily Wastewater

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Use in well ventilated areas. In confined spaces, mechanical ventilation may be required to maintain airborne concentrations below applicable workplace exposure levels. Potential airborne contaminant concentrations must be evaluated by designated and properly trained personnel.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.

Hand Protection Avoid skin contact. Use disposable neoprene, rubber, or vinyl gloves. Thermal protective gloves are required when water temperatures are above 120° F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.

Body Protection Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.

Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, solvents, or harsh abrasive skin cleaners.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
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SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Transparent, white to grey color.	Odor	Hydrocarbon.
Specific Gravity	1 (Water = 1) (Estimated.)	pH	Not Applicable.	Vapor Density	>1 (Air = 1)
Boiling Range	100°C (212°F)			Melting/Freezing Point	0°C (32°F)

Oily Wastewater

Vapor Pressure	Not determined.	Volatility	Slightly volatile.
Solubility in Water	Easily soluble in cold water. Soluble in methanol.	Viscosity (cSt @ 40°C)	Not determined.
Additional Properties	No additional information.		

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from water reactive materials.		
Materials Incompatibility	May react or be incompatible with acids.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Oily Wastewater This material may contain ammonium bisulfide, hydrogen sulfide and light hydrocarbons including oxygenates in the aqueous phase up to the limit of water-solubility of these compounds. The oil phase (if present) may contain a full range of hydrocarbons, depending upon the source of the stream. Since this material has not been fully characterized according to components, measures should be taken to minimize exposure to vapors and to avoid skin contact.
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SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material.
Environmental Fate	This product is miscible in water and is expected to readily disperse in marine environments.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. Use approved treatment, transporters, and disposal sites in compliance with applicable regulations.

Oily Wastewater

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: No SARA 311/312 hazard categories identified.
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: No components were identified.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This product or refinery stream is not known to contain chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This product is not known to contain the any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	

Oily Wastewater

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1200
 Revision Date 3/18/2004
 Print Date Printed on 3/18/2004.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist:	AIHA: American Industrial Hygiene Associator					
IARC: International Agency for Research on Cancer	NTP: National Toxicology Program					
NIOSH: National Institute of Occupational Safety and Health	OSHA: Occupational Safety and Health Administration					
NPCA: National Paint and Coating Manufacturers Association	HMIS: Hazardous Materials Information System					
NFPA: National Fire Protection Association	EPA: US Environmental Protection Agency					

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***** END OF MSDS *****



Sour Water at Crude Units

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0914
Revision Date 01/07/2000

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid		
Color	Colorless, water white, yellow, brown, or black.	Odor	Faint to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal.

DANGER! Contains Hydrogen Sulfide (H₂S) and Ammonia (NH₃)! Extremely flammable and toxic vapor may be released if this mixture is subjected to high heat or hot surfaces, contact with acids, or severe agitation! Vapor may cause flash fire or explosion! May react violently with acids, acidic solutions, or halogenated materials! Reactions may generate extremely flammable hydrogen (H₂) gas! May be harmful or fatal if inhaled or ingested! High concentrations of vapor may cause nervous system depression or paralysis and suffocation! Eye and/or skin irritation may result from vapor or liquid contact! May be corrosive to some metallic substances! Spills may create a slipping hazard!

Hazard Rankings

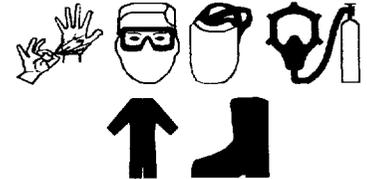
	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	4	4
Reactivity	1	1

COR

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Sour Water at Crude Units	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	1111110914	Medical Emergency	(918) 495-4700
CAS Number	Mixture—See Section 2.	CHEMTREC Emergency	(800) 424-9300
Product Family	Contaminated process water.		
Synonyms	Aqueous Solution Containing Hydrogen Sulfide and Ammonia, Crude Still Sour Condensate Water; H ₂ S/NH ₃ -Contaminated Crude Unit Process Water; Feed to the Sour Water Stripper Tower.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Water	7732-18-5	99.89-100
2) Hydrogen sulfide	7783-06-4	0 0005-0 1
3) Ammonia	7664-41-7	0.0001-0 01

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye contact. Inhalation Skin Absorption. Ingestion

Signs and Symptoms of Acute Exposure

Sour Water at Crude Units

Inhalation	Inhalation is not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of mist or liquid droplets may cause respiratory tract irritation, mucous membrane tissue burns, and possibly, pulmonary edema and chemical pneumonia. Generated vapor may be harmful or fatal if inhaled! Inhalation of the released vapor may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Ammonia vapors may cause severe lung effects which might be delayed in onset. Symptoms are characterized by coughing, choking, or shortness of breath. NIOSH has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H ₂ S cause unconsciousness and respiratory paralysis leading to coma and/or death. Also, NIOSH has determined that atmospheres containing 300 ppm or more of ammonia (NH₃) are immediately dangerous to life and health. (See Section 11.)
Eye Contact	Direct liquid contact may cause eye irritation upon short-term exposure and can produce severe, and possibly permanent, tissue damage if not promptly removed. The severity of the effects depend on the concentration of the ammonia component and how soon after exposure the eyes are washed. Generated vapor may cause severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and ammonia and duration of exposure.
Skin Contact	May be slightly irritating to corrosive to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours to a day for a dilute solutions (LT 0.04 wt.% ammonia). Prolonged or repeated contact, even to dilute concentrations of ammonia solutions , may cause some degree of permanent tissue destruction. Hydrogen sulfide can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.
Ingestion	Ingestion is unlikely. However, if swallowed, this material may cause gastrointestinal tract irritation, nausea, and vomiting, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon the ammonia concentration, ulceration of the gastrointestinal tract may also occur.
Chronic Health Effects Summary	Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H ₂ S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. Chronic dyspnea, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several workers two years after their occupational overexposures to mists or aerosols of ammonia . Also, when ingested by rats, aqueous ammonia solutions have been shown to cause gastrointestinal tract tumors. (See Section 11.)
Conditions Aggravated by Exposure	Personnel with pre-existing eye, skin, or gastrointestinal disorders, nervous system diseases, impaired kidney function, or chronic respiratory diseases neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material's components. They should take additional precautions to minimize or avoid exposure.
Target Organs	The material is potentially toxic to eyes, skin, mucous membranes, lungs, nervous systems, brain, kidneys, and possibly the blood, heart, and/or the endocrine and reproductive systems.
Carcinogenic Potential	This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP. (See Section 11.)

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Sour Water at Crude Units

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with water under a cool or cold shower for at least 15 minutes while removing contaminated shoes and clothing. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases, and groin area. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.
Notes to Physician	<p>If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a dilute solution of boric acid or acetic acid.</p> <p>Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.</p> <p>Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Sour water is non-flammable under normal conditions of use, however, if improperly handled, generated H ₂ S or H ₂ vapors are Extremely Flammable!		
Flash Point/Method	Not applicable or AP -73°C (-100°F) for H ₂ S		
Lower Flammable Limit	Not applicable or AP 4.0% for H ₂ S.	Upper Flammable Limit	Not applicable or 45% for H ₂ S
Auto-Ignition Temp.	Not applicable or AP 260°C (500°F) for H ₂ S		
Hazardous Combustion Products	Contact with some metals can generate extremely flammable hydrogen (H ₂) gas. This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Special Properties	High heat, hot surface contact, or mixing with acids may spring steam, extremely flammable H ₂ S, and/or toxic NH ₃ vapors out of this solution. H ₂ S is heavier than air and may travel long distances along the ground to an ignition source and flash back. It may also create a vapor/air explosion hazard in confined spaces such as in sewers. Adding this mixture directly to unbuffered water may cause a slightly exothermic reaction.		
Extinguishing Media	Non-combustible, if handled and stored properly. Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.		
Fire Fighting Protective Clothing	This material is not expected to burn. However, in the event that gases are being generated or surrounding materials are involved in a fire, firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.		

Sour Water at Crude Units

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Avoid contact with damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. For large spills, dike far ahead of spill to maximize later product recovery or disposal. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and proper protective clothing during cleanup operations. This material may react strongly with acids. Never flush to the sewer. In urban areas, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists to minimize physical habitat damage. If appropriate, neutralize with a dilute solution of boric acid or acetic acid. A vacuum truck may be used to collect the bulk. Spills on other than pavement may be handled by removing the affected soil and placing it into approved containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

Do not breathe mist or vapor. Do not get in eyes, on skin, or on clothing. Wear suitable personal protective equipment to prevent eye and skin contact. Wash thoroughly after handling.

Danger! Corrosive or Irritating Liquid and/or Poisonous and Flammable Gas! Do NOT breathe mist or vapor; it may contain hydrogen sulfide (H₂S), and/or ammonia (NH₃). Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow material to contact eyes, skin or other tissues, and clothing. Wear corrosion-resistant protective work clothing and chemical splash goggles and face shield when contact is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for H₂S concentrations and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable, corrosive, and/or poisonous residue.

Storage

Store in containers appropriate for dilute ammonia solutions and away from acids. Diluted material may accelerate corrosion of metal containers.

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room. The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

No special ventilation is required under normal conditions of use. Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Where hydrogen sulfide and/or ammonia may be generated, special ventilation will be required. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Sour Water at Crude Units

Eye Protection	Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Thermal protection should be provided if the solution has a temperature above 120 degrees F. Suitable eye wash water should be readily available.
Hand Protection	Avoid skin contact. Use of chemical-resistant gloves (e.g., PVC, neoprene, rubber, or vinyl) is required. Thermal protection should be used whenever the solution has a temperature above 120 degrees F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.
Body Protection	Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (e.g., vinyl, Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. Thermal protection should be provided when the solution has a temperature above 120 degrees F. If general contact occurs, IMMEDIATELY remove soaked clothing and shower thoroughly. Contaminated leather goods should be removed immediately and discarded.
Respiratory Protection	Misting or vapor generation is not expected under normal conditions of use; so respiratory protection is not anticipated under normal use conditions and with adequate ventilation. However, when anticipated or if generated hydrogen sulfide or ammonia are present at concentrations above applicable workplace exposure levels, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g., ANSI Z88.2).
General Comments	Releases of loosely bound hydrogen sulfide and/or ammonia may create flammable, explosive, toxic, and/or oxygen-deficient atmospheres (LT 19.5 Vol % in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency and hydrogen sulfide. Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners. Exposure standards/control limits for some of the components apply to airborne concentrations of dust, and are not truly applicable to liquid solutions. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1999] TWA: 5 (ppm) from ACGIH (TLV) [2000]
2) Ammonia	TWA: 10 STEL: 15 CEIL: 20 (ppm) from OSHA (PEL) [1989] TWA: 25 STEL: 35 (ppm) from ACGIH (TLV) [1999] STEL: 35 (ppm) from OSHA (PEL) [1989] TWA: 50 STEL: 35 (ppm) from OSHA (PEL) [1976]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Colorless, water white, yellow, brown, or black.	Odor	Faint to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal.
Specific Gravity	1.0 to 1.01 (Water = 1)	pH	4.0 to 8.0 [Moderately Acidic to Neutral]	Vapor Density	0.59 to 1.18
Boiling Point/Range	-79° to 100°C (-110° to 212°F) at 14.7 psia	Melting/Freezing Point		Viscosity (cSt @ 40°C)	-129° to 0°C (-200° to 32°F) at 14.7 psia.
Vapor Pressure	212 to 394 psia at 100°F (based upon H ₂ S and NH ₃)	Volatility Characteristics		Additional Properties	Not applicable
Solubility in Water	Completely soluble in cold water.			Volatility Characteristics	Negligible volatility in proper storage.
Additional Properties	No additional information				

Sour Water at Crude Units

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from strong acids, heat and hot surfaces, strong oxidizing conditions, and severe agitation. Contact with some metals can generate extremely flammable hydrogen (H ₂) gas. Avoid direct contact with organic halogen compounds		
Materials Incompatibility	Strong acids, halogenated compounds, and some heavy metals. Ammonia solutions are corrosive to chromium and silver and alloys containing these metals and will react violently with their powdered forms		
Hazardous Decomposition Products	Free aromatic amines may be released in a reducing environment.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Hydrogen sulfide

- GAS (TCLo): Acute: 10 ppm for 15 minutes [Human] - Eye irritation.
- GAS (TCLo): Acute: 50 to 100 ppm for 15 minutes [Human] - Respiratory irritation
- GAS (LC₁₀₀): Acute: 600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death
- GAS (LCLo): Acute: 5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death.

Ammonia:

- ORAL (LDLo): Acute: 132 mg/kg [Human].
- ORAL (TDL0): Acute: 15 uL/kg [Human] - Structural changes in the esophagus.
- GAS (TCLo): Acute: 20 ppm for 1hour [Human] - Eye irritation, ulcerated nasal septum, and structural changes in the trachea or bronchi.
- GAS (LCLo) Acute: 5,000 ppm for 5 minutes [Human].
- GAS (LCLo) Acute: 5,000 ppm for 5 minutes [Guinea Pig].
- GAS (LC₅₀) Acute 2,000 ppm for 4 hours [Rat]
- GAS (LC₅₀): Acute: 7,000 mg/m³ for 1 hour [Cat and Rabbit] - Excitement and flaccid paralysis without anesthesia.
- GAS (LC₅₀): Acute: 4,230 ppm for 1 hour [Mouse] - Ataxia, tremors, and convulsions.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Ammonia is a strong base and forms **ammonium hydroxide** upon contact with water. This material is corrosive to many organic compounds. If ingested, ammonia can cause severe pain, bloody diarrhea, cardiovascular collapse, and death. Concentrated ammonia is a strong corrosive which can cause burns of the following types: cryogenic from contact with refrigerated liquid, thermal from exothermic reaction with water, and chemical from its alkalinity. It gelatinizes the tissue, forming deep and painful lesions. At low concentrations, aqueous ammonia is a moderate to strong irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. Its effects on the lungs can be severe and delayed in onset, respiratory support may be required following acute inhalation. However, there seems to be a wide variability in the human sensitivity to ammonia.

Chronic dyspnea, restrictive lung dysfunction, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several employees two years after their occupational overexposures to mists and aerosols of ammonia. An aqueous ammonia solution caused gastrointestinal cicatricial tumors in rats following a 24-week feeding assay. NH₃ produced a positive mutagenic response in the Ames Assay and caused chromosomal aberrations during a 16-week cytogenic study using rats. However, in general, pH alterations produce false positive results in short-term genetic assays.

Sour Water at Crude Units

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Vapor releases from this material are expected to cause significant immediate impact but only localized non-persistent environmental damage. Due caution should be exercised to prevent an accidental release into the environment. This material and any contaminated soil or other water may be hazardous to human, animal, and aquatic life. Volatile components may contribute to smog formation.
Environmental Fate	This material is soluble in water and is expected to readily disperse in marine environments. Acidic solutions have produced slight to moderate toxicity in laboratory tests with aquatic organisms. It is expected to be moderately acidic or neutral. If released to surface water, it may cause a pH reduction depending upon the buffering capacity of the waterbody. Aquatic organisms become increasingly stressed as pH concentration approaches 5.0, with many species being intolerant of pH of 4.0 or lower. Substances in this mixture do not bioaccumulate. For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Maximize component recovery prior for reuse or recycling. Potential treatment and disposal methods include steam stripping, bio-oxidation, incineration, and land disposal, if permitted. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Flammable liquid, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Ammonia)		
Hazard Class	DOT CLASS: 3 (Flammable liquid).	Packing Group(s)	PG II
		UN/NA ID	UN1992
Reportable Quantity	A Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are Hydroxide sulfide and Ammonia.		
Placards			Emergency Response Guide No. 131
			HAZMAT STCC No. 49 203 78
			MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

Sour Water at Crude Units

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material contains detectable concentrations of the following chemical substances subject to this statute: Hydrogen sulfide [CAS No. 7783-06-4] and Ammonia [CAS No. 7664-41-7] .
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) & Chronic (Delayed) Health, Sudden Release of Pressure, Fire, and Reactivity Hazards
SARA 313	This material does not contain any components in concentrations which might be at or above de minimis levels and are listed as a toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Hydroxide sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.4 kg]) concentration: 0.0005 to 0.1% Ammonia [CAS No. 7664-41-7] (RQ = 100 lbs. [45.4 kg]) concentration: 0.0001 to 0.01%
CWA	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm; and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. A chemical substance present in this material which is subject to this statute is: Hydroxide sulfide [CAS No. 7783-06-4]

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	1 0
Revision Date	01/07/2000
Print Date	Printed on 01/11/2000.

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists				AIHA = American Industrial Hygiene Association		
IARC = International Agency for Research on Cancer				NTP = National Toxicology Program		
NIOSH = National Institute of Occupational Safety and Health				OSHA = Occupational Safety and Health Administration		
NPCA = National Paint and Coating Manufacturers Association				HMIS = Hazardous Materials Information System		
NFPA = National Fire Protection Association				EPA = Environmental Protection Agency		

Sour Water at Crude Units**DISCLAIMER OF LIABILITY**

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0915
HFR #341

Sour Water

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0915
Revision Date 9/6/2006

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 3	3
Fire Hazard	4	4
Reactivity	1	1

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Colorless to light yellow.
Odor Hydrogen sulfide or ammoniacal

DANGER!

Contains extremely flammable and poisonous gas.
Contains Hydrogen Sulfide gas (H₂S) and ammonia. May be fatal if inhaled.
Extremely flammable and poisonous gas may be released if this material is heated or comes in contact with acids. Vapor may cause flash fire or explosion.
Liquid contact may cause eye and skin irritation.

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Sour Water	Technical Contact	(800) 525-4692
Product Number	RS0915	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Refinery Intermediate Stream		
Synonyms	Feed to Sour Water Stripper; Aqueous Solution Containing Hydrogen Sulfide and Ammonia		

SECTION 2. COMPOSITION (TYPICAL)

All liquids are listed on a weight % basis while gases are listed on a mole % basis.

Component Name(s)	CAS Registry No.	Concentration (%)
Water	7732-18-5	94-99.9
Hydrogen Sulfide	7783-06-4	0.01-4
Ammonia	7664-41-7	0.1-2

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

Sour Water

Inhalation	Inhalation is not a normal route of exposure for an aqueous liquid. However, vapor generated from this material may be harmful or fatal if inhaled. Contains hydrogen sulfide. Inhalation of gas or vapor may cause severe nose, throat, respiratory tract, and lung irritation, respiratory paralysis, and death, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath.
Eye Contact	Causes severe eye irritation with tearing, redness, or a stinging or burning feeling. May cause swelling of the eyes with blurred vision. Can injure eye tissue. Effects may become more serious with repeated or prolonged contact. Vapors may cause eye irritation and light sensitivity. Severity depends upon the concentration and duration of exposure.
Skin Contact	May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact.
Ingestion	May cause nausea, vomiting and/or diarrhea, in addition to burning sensation in the mouth, throat, and digestive tract.
Chronic Health Effects Summary	Subacute exposure to low levels of hydrogen sulfide can produce eye irritation, watering, light sensitivity and corneal opacity. Reported effects from subacute exposure also include bronchitis, pulmonary edema, nausea, abdominal cramps and diarrhea. See toxicological Information (section 11).
Conditions Aggravated by Exposure	Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Respiratory System, Central Nervous System (CNS)
Target Organs	May cause damage to the following organs: lungs, mucous membranes, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.
Carcinogenic Potential	This product is not known to contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification			OSHA Physical Hazard Classification						
Irritant	<input type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. Flush eyes with cool, clean, low-pressure water for at least 15 minutes while occasionally lifting and lowering eyelids. Do not use eye ointment unless directed to by a physician. Seek medical attention if excessive tearing, irritation, or pain persists.

Sour Water

Skin Contact	Wash exposed skin well with plenty of soap and water. If on clothing or shoes, remove and wash well before reuse. If symptoms develop and continue, get medical attention.
Ingestion	Do not induce vomiting unless directed to by a physician. Do not give anything to drink unless directed to by a physician. Never give anything by mouth to a person who is not fully conscious. Seek medical attention immediately.
Notes to Physician	<p>INHALATION: Inhalation overexposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.</p> <p>Treat symptomatically.</p>

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Non-flammable under normal conditions of use but may generate highly flammable H ₂ S or H ₂ vapor under certain conditions.		
Flash Point	Not applicable.		
Lower Flammable Limit	Not applicable for aqueous stream; 4% for H ₂ S	Upper Flammable Limit	Not applicable for aqueous stream; 45% for H ₂ S
Autoignition Temperature	Not determined.		
Hazardous Combustion Products	Aqueous phase does not support combustion. Burning of oil layer (if any) will liberate carbon dioxide, carbon monoxide, smoke, fumes, and/or unburned hydrocarbons.		
Special Properties	This material may evolve hydrogen sulfide (H ₂ S), a highly flammable and poisonous gas. Always check for hazardous vapors and take appropriate precautions.		
Extinguishing Media	Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Extremely Flammable and Poisonous Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area far upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Allow any entrained liquid spills to evaporate. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

Closed gas systems form white-colored frost at the point of a leak. Do not direct water at the source of leak. Do not enter a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing. Use water spray to reduce vapors or divert vapor cloud drift. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during response operations. This gas may travel great distances and be ignited by a remote ignition source.

Sour Water

SECTION 7. HANDLING AND STORAGE

Handling	<p>Monitor for H₂S during tank gauging and similar operations.</p> <p>Do not breathe vapor or mist. Do not get in eyes, on skin or on clothing. Wear suitable personal protective equipment to prevent eye and skin contact. Wash thoroughly after handling.</p> <p>Use appropriate respiratory protection.</p>
Storage	<p>Store in containers appropriate for dilute caustic solutions and away from acids. Material may accelerate corrosion of metal containers.</p>

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Local exhaust and general room ventilation may be required in work areas to prevent accumulation of mixtures of gas and air that may ignite with explosive force. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station. Where H₂S is routinely stored or handled, install monitoring equipment or system with alarms.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection	Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling sampling cylinders, pressurized containers and piping systems. If gas is being transferred or released, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required.
Hand Protection	Avoid skin contact. Use disposable neoprene, rubber, or vinyl gloves. Thermal protective gloves are required when water temperatures are above 120° F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.
Body Protection	Avoid skin contact. Wear protective clothing if splashing or spraying is expected. Protective clothing may include long-sleeved clothing, apron, slicker suit and/or boots. Thermal protection is required for process waters above 120° F.
Respiratory Protection	Contaminant air concentrations determine the level of respiratory protection required. Use only NIOSH-approved respiratory equipment within the limits of the protection factors for that equipment. Use supplied air respirators when H ₂ S concentrations are expected to exceed applicable workplace exposure levels. Do not use air purifying respiratory equipment when considering elevated H ₂ S concentrations. Respiratory equipment must be selected on the basis of the maximum expected air concentration.
General Comments	Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
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Sour Water

Hydrogen Sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Ammonia anhydrous	ACGIH (United States, 2000). TWA: 25 ppm STEL: 35 ppm OSHA (United States, 1989). STEL: 35 ppm TWA: 50 ppm STEL: 35 ppm

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Colorless to light yellow.	Odor	Hydrogen sulfide or ammoniacal
Specific Gravity	1 (Water = 1) (Estimated.)	pH	8-12	Vapor Density	>1 (Air = 1)
Boiling Range	AP 100° C (AP 212° F)			Melting/Freezing Point	0°C (32°F)
Vapor Pressure	The highest known value is 2.3 kPa (17.5 mm Hg) (at 20°C) (Water).			Volatility	Non-volatile.
Solubility in Water	Easily soluble in cold water. Soluble in methanol.			Viscosity (cSt @ 40°C)	Not determined.
Flash Point	Not applicable.				
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from water reactive materials. Keep away from extreme heat, strong acids and strong oxidizing conditions.		
Materials Incompatibility	May react or be incompatible with acids.		
Hazardous Decomposition Products	Depending upon the conditions of use, low concentrations of hydrogen sulfide can be released.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Sour Water

Toxicity Data

Hydrogen Sulfide

INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse]. Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations above 100 ppm are immediately dangerous to life and health.

SECTION 12. ECOLOGICAL INFORMATION

- Ecotoxicity** An environmental fate analysis has not been conducted on this specific product. Releases are expected to cause significant immediate impact but only localized non-persistent environmental damage.
- Environmental Fate** This product is not expected to bioaccumulate through food chains in the environment.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitability (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

- TSCA Inventory** This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
- SARA 302/304
Emergency Planning
and Notification** The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Hydrogen sulfide (I), CAS Number, 7783-06-4 Concentration: 2.005%

Sour Water

SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above <i>de minimis</i> levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Hydrogen Sulfide [CAS No.: 7783-06-4] Concentration: 2%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Hydrogen Sulfide [CAS No.: 7783-06-4] RQ = 100 lbs. (45.36 kg) Concentration: 2%
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This product is not known to contain any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.00
Revision Date 9/6/2006
Print Date Printed on 9/6/2006.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR

Sour Water

PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Recovered Light Slop Oil from Waste Water Treatment Plant

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0921
Revision Date 10/28/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid.		
Color	Transparent, water white to opaque black.	Odor	Characteristic ethereal or pleasant and sweet aromatic hydrocarbon. Its odor threshold is 2-7 ppm in air.

DANGER! Extremely flammable liquid; vapor may cause flash fire or explosion!
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!
Liquid contact may cause minimal to severe eye irritation and/or mild to severe skin irritation and inflammation!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and target organ effects like blood or blood-forming tissue damage!
May be harmful or fatal if ingested! Aspiration into the lungs may cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
May contain low levels of Benzene!
Possible cancer hazard; may cause leukemia and other blood disorders!
Mutagenic hazard; may cause genetic damage!
Based on component animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

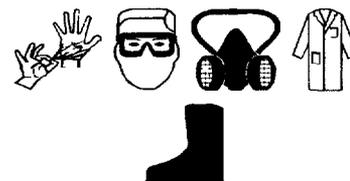
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Recovered Light Slop Oil from Waste Water Treatment Plant	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	068956707*	Medical Emergency	(918) 495-4700
CAS Number	68956-70-7	CHEMTREC Emergency	(800) 424-9300
Product Family	C6-C12 Hydrocarbons and possibly Water and/or Methyl tert-Butyl Ether		
Synonyms	A.P.I. Separator Forebay Skimmings; Light Slop Oil, Slop Naphthas, Recovered Naphthas; Reclaimed Light Oil; Wastewater Treatment Plant Reclaimed Light Oil		

Recovered Light Slop Oil from Waste Water Treatment Plant

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Slop Oil, C6 and Greater Hydrocarbons	68956-70-7	98-99.9
2) C6-C12 Hydrocarbons	8006-61-9	98-99.9
3) Hexane Isomers	Mixture	5-15
4) n-Hexane	110-54-3	1-5
5) Benzene	71-43-2	0-0.5
6) Heptanes	Mixture	10-20
7) Octanes	Mixture	10-20
8) Nonanes	Mixture	5-15
9) Water	7732-18-5	0.1-2
10) Methyl tertiary-butyl ether (MTBE)	1634-04-4	0-1.5

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol %) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from an exposure of 5,000 to 10,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results and actual human exposures of this material's components suggest that this product can cause minimal to severe eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results and actual human exposures of this material's components suggest that this product can cause mild to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, abdominal pain, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above). Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.
Chronic Health Effects Summary	Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Reports have associated repeated and prolonged occupational overexposure to solvent naphthas with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for naphtha abusers. Intentional misuse by deliberately concentrating and inhaling the gasoline portion of this material may be harmful or fatal. Acute symptoms caused by methyl tertiary-butyl ether (MTBE) appear to be mild and transient. Laboratory rodents exposed to high doses of MTBE exhibited blood chemistry changes and liver and kidney abnormalities. The no observable effect level (NOEL) was reported to be 800 ppm and the NOEL for neurotoxicity was determined to be 2,880 mg/m ³ . In animal studies, developmental and reproductive toxicity were only observed at materially toxic levels of MTBE.

Recovered Light Slop Oil from Waste Water Treatment Plant

Various oncogenicity studies resulted in kidney, liver, and/or testicular tumors following exposures by inhalation and/or ingestion. These tumors are believed to be caused by **MTBE's formaldehyde metabolite**; however, IARC and ACGIH have listed **MTBE** as "possibly carcinogenic to humans (2B)" and as an "animal carcinogen (A3)", respectively. Available epidemiology studies do not confirm an increased risk of cancer in exposed humans and NTP's Board of Scientific Counselors declared that "available evidence suggests that **MTBE** is not reasonably anticipated to cause cancer in humans except under uncommon or unlikely routes or levels of exposure"

Even with acute exposures, **n-hexane** is toxic to the peripheral nerves, characterized by numbness, tingling, or pain in the extremities, progressively worsening of neuromuscular motor coordination (polyneuritis or polyneuropathy), and even partial paralysis. And, based upon animal studies, **n-hexane's metabolite, 2,5-hexanedione**, has been shown to cause degeneration of the testes.

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents. (See Section 11.)

Conditions Aggravated by Exposure

Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, liver or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Special precautions are necessary for pregnant women and nursing mothers.

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

This substance is toxic to lungs, nervous system, especially the peripheral nerves, brain, mucous membranes, skin, eyes, and possibly, the blood, bone marrow and other blood-forming tissues, heart, liver, kidneys, and reproductive systems.

Carcinogenic Potential

This material may contain **benzene** and/or **methyl tert-butyl ether (MTBE)** components at concentrations at or above 0.1%. **Benzene** is considered carcinogenic by OSHA, IARC, and NTP and **MTBE** is considered possibly carcinogenic by IARC. See Section 11.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input checked="" type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation

Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact

Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact

Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Recovered Light Slop Oil from Waste Water Treatment Plant

Ingestion

Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA Flammable Liquid Extremely flammable!		
Flash Point/Method	CLOSED CUP: -35° to -18°C (-30° to 0°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.0%	Upper Flammable Limit	AP 15.1%
Auto-Ignition Temp.	AP 232°C (450°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	Extremely Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Recovered Light Slop Oil from Waste Water Treatment Plant

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Recovered Light Slop Oil from Waste Water Treatment Plant

Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Released vapors may cause extremely flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special safety precautions including monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

1) Gasoline ("A3" Animal Carcinogen)	TWA: 300 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 500 (ppm) from OSHA (PEL) [1989]
2) Petroleum Distillates (Naphtha)	TWA: 400 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
3) Methyl tert-butyl ether (MTBE) ("A3" Animal Carcinogen)	TWA: 40 (ppm) from ACGIH (TLV) [1999]
4) Hexane (n-Hexane)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 50 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
5) Hexane, other isomers	TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [1999] TWA: 500 STEL: 1000 (ppm) from OSHA (PEL) [1989]
6) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
7) Heptane (n-Heptane)	TWA: 400 STEL: 500 (ppm) from ACGIH (TLV) [1999] TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
8) Octane, all isomers	TWA: 300 (ppm) from ACGIH (TLV) [1999] TWA: 300 STEL: 375 (ppm) from OSHA (PEL) [1989] TWA: 500 (ppm) from OSHA (PEL) [1976]
9) Nonane, all isomers	TWA: 200 (ppm) from ACGIH (TLV) [1999] TWA: 200 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, water white to opaque black.	Odor	Characteristic ethereal or pleasant and sweet aromatic hydrocarbon. Its odor threshold is 2-7 ppm in air.
Specific Gravity	0.70 to 0.86 (Water = 1)	pH	Not applicable or 6.0 to 7.0	Vapor Density	3.0 to 3.2 (Air = 1)
Boiling Point/Range	-12° to 204°C (10° to 400°F)	Melting/Freezing Point			-160° to 13°C (-255° to 55°F)
Vapor Pressure	95 to 245 mm Hg at 20°C (68°F).	Viscosity (cSt @ 40°C)			0.5 to 2
Solubility in Water	The MTBE portion of this mixture will readily solubilize in cold water, but the hydrocarbons are only slightly soluble in cold water (0.1 to 0.5%).	Volatile Characteristics			Volatile Organic Compounds (VOCs) Content = 0.1 to 1%, Volatile portion = 700 to 900 gm/L

Recovered Light Slop Oil from Waste Water Treatment Plant

Additional Properties

C6-C9 Aromatic Hydrocarbon Content = 0.01 to 1 Wt.% (ASTM D-1319);
 Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 98 to 99 Wt.% (ASTM D-1319);
 Average Density at 60°F = 5.994 to 7.161 lbs./gal (ASTM D-2161);
 Dry Point Temperature = 392°F (200°C) (ASTM D-86);
 Evaporation Rate = 5 to 10 when n-Butyl acetate = 1.0

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks, and other ignition sources, strong oxidizing conditions, and freezing temperatures.		
Materials Incompatibility	Strong acids, especially nitric acid, alkalis, and oxidizers such as liquid chlorine, many fluorides, perchlorates, and other halogens, hydrogen peroxide, and oxygen. n-Heptane will dissolve some plastics.		
Hazardous Decomposition Products	No substances are readily identified from composition; but, no degradation data is available.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Unleaded Gasoline:

GAS (TELo) Acute: 140 ppm (Human) (8 hours) - Mild eye irritant!
 GAS (TELo) Acute: 500 ppm (Human) (1 hour) - Moderate eye irritant!
 GAS (TCLo) Acute: 900 ppm (Human) (1 hour) - CNS and pulmonary effects
 DERMAL (TDLo): Acute: 53 mg/kg (Human) - Skin allergy effects.

Methyl tertiary-Butyl Ether (MTBE):

ORAL (LD50): Acute: 4,000 mg/kg [Rat]
 ORAL (LD50): Acute: 5,900 uL/kg [Mouse]
 GAS (LC50): Acute: 23,576 ppm for 4 hours [Rat].
 GAS (LC50): Acute: 14,000 mg/m³ for 15 minutes [Mouse] - General anesthesia.
 INTRAPERITONEAL (LD50): Acute: 1,700 uL/kg [Mouse]

n-Hexane:

GAS (LC50): Acute: 48,000 ppm for 4 hours [Rat].
 ORAL (LD50): Acute: 28,710 mg/kg [Rat].

Benzene:

ORAL (LD50): Acute: 930 mg/kg [Rat] - Tremors and convulsions
 ORAL (LD50): Acute: 4,700 mg/kg [Mouse].
 ORAL (LD50): Acute: 5,700 mg/kg [Unidentified mammal]
 GAS (LC50): Acute: 10,000 ppm for 7 hours [Rat].
 GAS (LC50): Acute: 9,980 ppm for 8 hours [Mouse] - General anesthesia, muscle weakness, and dyspnea.

DERMAL (LD50) Acute: 48 mg/kg [Mouse].
 DERMAL (LD50): Acute: GT 9,400 uL/kg [Rabbit and Guinea Pig].
 INTRAPERITONEAL (LD50): Acute: 340 mg/kg [Mouse].
 INTRAPERITONEAL (LD50): Acute: 2,890 ug/kg [Rat] - Lung and liver damage plus decreased blood cells.

n-Heptane:

GAS (LC50): Acute: 103,000 mg/m³ for 4 hours [Rat] - Convulsions.
 DERMAL (LD50): Acute: GT 2,000 mg/kg [Rabbit].
 INTRAVENOUS (LD50): Acute: 222 mg/kg [Mouse].

n-Octane:

GAS (LC50): Acute: 118,000 mg/m³ for 4 hours [Rat]

n-Nonane

GAS (LC50) Acute: 3,200 ppm for 4 hours [Rat]
 INTRAVENOUS (LD50): Acute: 218 mg/kg [Mouse].

Recovered Light Slop Oil from Waste Water Treatment Plant

Two-year inhalation toxicity studies with **fully-vaporized unleaded gasoline** at concentrations of 67, 292, and 2,056 ppm in air produced kidney damage and kidney tumors in male rats, but not in female rats or mice of either sex. Female mice developed a slightly higher incidence of liver tumors compared to controls at the highest concentration. Results from subsequent scientific studies suggest that the kidney damage, and probably the kidney tumor response, is unique to the male rat. Two-year inhalation toxicity studies with fully vaporized unleaded gasoline (at 67, 292, & 2,056 ppm in air) produced kidney damage and kidney tumors in male rats, but not in female rats or mice of either sex. Female mice developed a slightly higher incidence of liver tumors compared to controls at the highest concentration. Results from subsequent scientific studies suggest that the kidney damage, and probably the kidney tumor response, is unique to the male rat. An EPA draft policy statement takes account of alpha-2u-globulin findings as a basis for discarding male rat kidney data in determining whether gasoline is a carcinogen.

There were no benzene-induced blood toxin or leukemia effects noted in laboratory animals following long-term exposures to **fully-volatilized unleaded gasoline vapors containing 2 Vol.% benzene**. However, the relative risk to humans for benzene in gasoline is still unknown.

Laboratory rodents exposed to high doses of **methyl tertiary-butyl ether (MTBE)** exhibited blood chemistry changes and liver and kidney abnormalities. The no observable effect level (NOEL) was reported to be 800 ppm. And in rats, the NOEL for neurotoxicity was determined to be 2,880 mg/m³. Acute symptoms caused by MTBE appear to be mild and transient.

Most mutagenicity test results on **MTBE** including the Petroleum-modified Ames Test, indicate that it is NOT mutagenic. However, the Mouse Lymphoma Assay showed a positive response under certain conditions. This positive result is thought to be due to a metabolite (formaldehyde), not directly from MTBE. Also, there is a high incidence of false positive findings in this particular assay. Therefore, it can be concluded that this positive finding was an aberrant response.

MTBE vapors caused an increased incidence of liver tumors in female mice following 18 months of 8,000 ppm exposure. Lower exposure concentrations did NOT cause liver tumor response. Following 24 months of this 8,000 ppm MTBE exposure, male rats showed an increased incidence of kidney and testicular tumors. Also, additional oncogenicity studies on two different strains of rats resulted in testicular tumors following exposures by inhalation and/or ingestion. These tumors are believed to be caused by **MTBE's formaldehyde metabolite**; however, IARC and ACGIH have listed MTBE as "possibly carcinogenic to humans (2B)" and as an "animal carcinogen (A3)", respectively. Available epidemiology studies do not confirm an increased risk of cancer in exposed humans and NTP's Board of Scientific Counselors declared that "available evidence suggests that MTBE is not reasonably anticipated to cause cancer in humans except under uncommon or unlikely routes or levels of exposure."

In animal studies, developmental and reproductive toxicity was only observed at materially toxic levels of **MTBE**. No maternal toxicity or birth defects were observed in rabbits up to 8,000 ppm, in rats up to 2,500 ppm, and in mice up to 1,000 ppm of MTBE exposure. However, MTBE was shown to cause maternal toxicity at 4,000 and 8,000 ppm levels when mice were exposed for 6 hours per day during their pregnancy. A decrease in the number of successful pregnancies and a reduction in birth weight was also seen at these exposure levels. A significant number of pups had a birth defect (cleft palate) at the 8,000 ppm level. These results suggest that the risk of birth defects in humans from MTBE is negligible at anticipated exposure concentrations from **gasoline**.

Benzene has an IDLH (immediately dangerous to life or health) concentration = 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes.

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children and teenagers have a lower resistance to bone marrow poisons.

Recovered Light Slop Oil from Waste Water Treatment Plant

Studies with pregnant laboratory animals have demonstrated that **benzene** is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice

Intentional sniffing abuse of **n-hexane** has caused permanent brain and nervous system damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function, and even paralysis. These neurological effects are pronounced in combination with lack of oxygen supply, especially amongst women. Chronic repeated and/or prolonged overexposure to **n-hexane**, either by inhalation or skin absorption, has been shown to cause peripheral nerve tissue damage (**polyneuropathy**). The initial symptoms are numbness of the fingers and toes. Motor weakness can also occur in the digits, but may also involve muscles of the arms, thighs, and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of **n-hexane** may be increased by concurrent exposure to **methyl ethyl ketone, methyl isobutyl ketone, and/or toluene**

n-Hexane is NOT a tumor promotor in mice and NOT considered to be carcinogenic, nor is it teratogenic in mice or rats. **n-Hexane**, or its metabolite **2,5-hexanedione**, has been shown to cause degeneration of the testes in rats, but, it did NOT produce spermatotoxicity in a multiple end-point test battery in rats given multiple doses for up to 5 days

n-Heptane is a mucous membrane and respiratory tract irritant, but non-irritating to the eyes. It is irritating to skin and readily absorbed by either inhalation or dermal exposure. Exposures may cause decreased red blood cell counts, liver and heart damage, and central nervous system depression. Repeated direct skin application can produce defatting dermatitis. **n-Heptane** is metabolized in the liver to form alcohols and ketones, including neurotoxic **2,5-heptanedione** which is detectable in small amounts in the urine of exposed humans.

In a controlled study, human volunteers exposed to an airborne concentration of **n-heptane** of 1,000 ppm for 6 minutes or 2,000 ppm for 4 minutes experienced slight dizziness and incoordination. Higher-level exposures produced hilarity, dizziness, and semi-consciousness. Inhaling a concentration of 5,000 ppm for 15 minutes caused stupor and a gasoline-like taste. These higher exposures also decreased the myocardial threshold to the arrhythmogenic effects (irregular heart beats) of epinephrine, producing only a narrow margin of safety between exposures causing CNS effects, cardiac effects, and loss of consciousness.

One occupational exposure study involving a **95% purity n-heptane** from 1 to 9 years duration concluded that it could produce minimal peripheral nerve damage with numbness and tingling of the extremities in the stocking-and-glove areas. In the same study, there was a decrease in motor nerve conduction velocities correlated with duration of exposure and adjusted for age effects; however, the average motor nerve conduction velocity in exposed workers was normal. Polyneuropathy associated with **n-heptane** exposure was reversible within a year following removal of exposure.

n-Heptane was not neurotoxic in rats exposed for up to 7 months. But based upon limited laboratory animal studies, **n-heptane and its metabolites** were found in low levels (LT 135 ppm) in the brain of rats exposed to airborne concentrations of 100, 500, or 1,500 ppm for 6 hours each day, five days per week, for 1 or 2 weeks. These substances disappeared within 2 weeks following removal of exposure. **n-Heptane** was not mutagenic in the Salmonella/microsome (Ames) assay and is not expected to be carcinogenic.

2,2,4-Trimethylpentane (iso-octane) was highly irritating to mice at a 1,000 ppm in air exposure for 5 minutes and respiratory arrest occurred at exposures above 10,000 ppm for 5 minutes. CNS depression was observed at concentrations between 8,000 and 10,000 ppm in air. Kidney tubule necrosis, hyaline droplet formation, and acute renal failure were seen in male rats following oral administration of 10 gm/kg, 8 mL/kg, or 2,100 mg/kg of iso-octane for 2, 3, and 4 weeks, respectively.

Rats inhaling **n-nonane** at an airborne concentration of 1,500 ppm for 7 days displayed mild tremors and loss of coordination. Inhalation of 1,600 ppm for 6 hours per day for 90 days showed animal weight loss or decreased weight gain and changes in the structure of their salivary glands. And, liver damage and an altered response to drugs were seen in rats given **n-nonane** for 2 to 7 days.

Recovered Light Slop Oil from Waste Water Treatment Plant

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, the **naphtha and MTBE** components of this mixture, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Its **MTBE** and prominent **aromatic hydrocarbon component (benzene)** are highly volatile and might contribute to the creation of atmospheric smog. **Benzene** has a half-life of from 4 to 6 hours when photochemically active hydroxyl radicals are present, especially when atmospheres are polluted with nitrogen oxides or sulfur dioxide. **Benzene** is very effectively washed out of the atmosphere by rain. **n-Hexane, n-heptane, hexane isomers, heptane isomers, and iso-octane** all have estimated half-lives of between 2.4 and 4.4 days in air when photochemical hydroxyl and/or nitrate radicals are present.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), the *naphtha* portion of this mixture showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), all these component substances showed 24-hour TLms of from 95 ppm to 400 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This naphtha and possibly MTBE mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. As the water temperature is lowered, the more the MTBE component will dissolve into the water phase increasing its toxicity. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination of MTBE and/or total hydrocarbons.

MTBE is not expected to persist in the atmosphere or hydrolyze, photolyze, or be absorbed in sediments or suspended particulate matter. Nor is it expected to bioconcentrate. However, it is expected to be highly mobile in soil with leaching into ground water likely.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol % of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol %, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Recovered Light Slop Oil from
Waste Water Treatment Plant**

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Flammable liquid, n o s (Heptanes, Octanes)		
Hazard Class	Class 3 Flammable liquid	Packing Group(s)	PG II
		UN/NA ID	UN1993
Reportable Quantity	The Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are n-Hexane and 2,2,4-Trimethylpentane (Iso-octane).		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 101 31
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This material may contain the following components in concentrations at or above de minimis levels and they are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313. n-Hexane [CAS No. 110-54-3] concentration: 1 to 5% Benzene [CAS No. 71-43-2] concentration: 0 to 0.5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which might be present in this material subject to this statute are: Methyl tert-butyl ether (MTBE) [CAS No. 1634-04-4] (RQ = 1000 lbs. [453.6 kg]) conc.: 0 to 1.5% n-Hexane [CAS No. 110-54-3] (RQ = 5,000 lbs. [2,270 kg]) concentration: 1 to 5% Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0 to 0.5% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 0.2% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 0 to 5% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 0.3% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 0.1%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material might contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is subject to requirements of California Health & Safety Code Section 25249.5: Unleaded Gasoline (Wholly Vaporized) [CAS No. 8006-61-9], Benzene [CAS No. 71-43-2], and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2

Recovered Light Slop Oil from Waste Water Treatment Plant

Additional Regulatory Remarks

Under Section 12(b) of the Toxic Substances Control Act: Because it may contain detectable amounts of **Methyl tertiary-Butyl Ether (MTBE) [CAS No. 1634-04-4]**, **Methylcyclopentane [CAS No. 96-37-7]**, **n-Hexane [CAS No. 110-54-3]**, **Cyclohexane [CAS No. 110-82-7]**, **n-Propylbenzene [CAS No. 103-65-1]** and other **C9 Aromatic Hydrocarbons**, this material might be subject to US EPA's one-time only per country export notification requirements

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Benzene [CAS No. 71-43-2]** and possibly **Cyclohexane [CAS No. 110-82-7]**, **Methylcyclohexane [CAS No. 108-87-2]**, **Toluene [CAS No. 108-88-3]**, **mixed Xylenes [CAS No. 1330-20-7]**, and **Ethylbenzene [CAS No. 100-41-4]**.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2 0
Revision Date 10/28/1999
Print Date Printed on 11/01/1999

ABBREVIATIONS

AP = Approximately Established	EQ = Equal	GT = Greater Than	LT = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



Benzene NESHAPS Stripper Tower Feed

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0922

Revision Date 10/04/1999

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid.	Odor	Characteristic, sweet and pleasant, aromatic hydrocarbon its odor threshold is 2-5 ppm in air
Color	Transparent, water white to hazy grey.		

DANGER or WARNING! Flammable liquid; vapor may cause flash fire!
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!

Liquid contact may cause minimal to severe eye and/or mild to severe skin irritation and inflammation!

May be harmful if inhaled or absorbed through the skin!

Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss and/or blood and blood-forming tissue damage!

May be harmful or fatal if ingested! Aspiration into the lungs may cause pulmonary edema and chemical pneumonia!

Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!

Contains Benzene! Cancer hazard; may cause leukemia and other blood disorders! Mutagenic hazard; may cause genetic damage!

Based on component animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

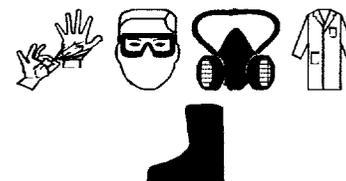
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Benzene NESHAPS Stripper Tower Feed	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	0092200922	Medical Emergency	(918) 495-4700
CAS Number	Mixture	CHEMTREC Emergency	(800) 424-9300
Product Family	Water and C6-C9 Petroleum Hydrocarbons		
Synonyms	Feed to 438 Unit; Sump Slop Collection or Wastewaters from Aromatics Units and Crude Desalters; Wastewaters containing Benzene and Light (BTX) Aromatics; Waterwater and Slop Aromatic Naphtha; Wastewater and C6-C9 Aromatic Hydrocarbon Mixture.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Water	7732-18-5	85-99.9
2) Benzene	71-43-2	0.1-5
3) Toluene	108-88-3	0-4
4) Xylene, Mixed Isomers	1330-20-7	0-3

**Benzene NESHAPS
Stripper Tower Feed**

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye Contact Absorption Inhalation

Signs and Symptoms of Acute Exposure

- Inhalation** Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from an exposure of 10,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
- Eye Contact** Animal test results and actual human exposures of this material's components suggest that this product can cause minimal to severe eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
- Skin Contact** Animal test results and actual human exposures of this material's components suggest that this product can cause minimal to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
- Ingestion** If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, abdominal pain, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary Chronic occupational **xylene** exposures have caused auditory nerve degeneration. Also, chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). And, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this naphtha may be harmful or fatal.

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Available information indicates that **toluene** is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Based upon animal testing, the **C8 aromatic hydrocarbon components (xylenes and ethylbenzene)** might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period (See Section 11)

**Benzene NESHAPS
Stripper Tower Feed**

Conditions Aggravated by Exposure Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Special precautions are necessary for pregnant women and nursing mothers

Exposure to high concentrations of this material may increase the sensitivity of the heart to **epinephrine (adrenalin) and catecholamine-like drugs**. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs This substance is toxic to lungs, central nervous system, especially the auditory nerve, brain, mucous membranes, skin, eyes, and possibly, the blood, bone marrow and other blood-forming tissues, heart, liver, kidneys, thymus, and reproductive systems.

Carcinogenic Potential This product contains a **benzene** component at concentrations at or above 0.1%. **Benzene** is considered carcinogenic by OSHA, IARC, and NTP. See Section 11.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910 1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
- Skin Contact** Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
- Ingestion** Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

**Benzene NESHAPS
Stripper Tower Feed**

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IA, IB, or IC Flammable Liquid, or Class II Combustible Liquid Extremely, highly, or moderately flammable!		
Flash Point/Method	CLOSED CUP: -11° to 40°C (12° to 140°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.0%	Upper Flammable Limit	AP 7.1%
Auto-Ignition Temp.	AP 432°C (810°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, and possibly other harmful gases/vapors.		
Special Properties	Flammable or Combustible Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors, but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

Benzene NESHAPS Stripper Tower Feed

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

Benzene NESHAPS Stripper Tower Feed

General Comments

Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Released vapors may cause extremely flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special safety precautions including monitoring for oxygen deficiency and flammability

Occupational Exposure Guidelines

Substance

- 1) Benzene ("A1" and "Z-2" Carcinogen)
- 2) Toluene ("A4" = Not Classifiable)
- 3) Xylene, Mixed Isomers ("A4" = Not Classifiable)

Applicable Workplace Exposure Levels

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1999] - SKIN
 TWA: 1 STEL: 5 AL: 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
 TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN
 TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989]
 TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
 TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1999]
 TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Transparent, water white to hazy grey.	Odor	Characteristic, sweet and pleasant, aromatic hydrocarbon its odor threshold is 2-5 ppm in air.
Specific Gravity	0.86 to 1.00 (Water = 1)	pH	6.0 to 7.0	Vapor Density	0 to 3.7 (Air = 1)
Boiling Point/Range	80° to 152°C (176° to 306°F)	Melting/Freezing Point			-95° to 13°C (-139° to 55°F)
Vapor Pressure	0 to 43 mm Hg at 20°C (68°F).	Viscosity (cSt @ 40°C)			0.1 to 2
Solubility in Water	Hydrocarbons portion of this mixture is slightly soluble in cold water (0.1 to 0.2%)	Volatile Characteristics			Volatile Organic Compounds (VOCs) Content = 0.1 to 15%; Volatile portion = 875 to 880 gm/L.
Additional Properties	C6-C9 Aromatic Hydrocarbon Content = 0.1 to 13 Wt.% (ASTM D-1319); Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = 0 to 1.5 Wt.% (ASTM D-1319); Average Density at 60°F = 7.269 to 8.345 lbs/gal. (ASTM D-2161), Dry Point Temperature = 292°F (145°C) (ASTM D-86), Evaporation Rate = 0 to 4.5 when n-Butyl acetate = 1.0; Heat Value = 0 to 18,500 Btu.				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, sparks, and other ignition sources, strong oxidizing conditions, and freezing temperatures.		
Materials Incompatibility	Strong acids, especially nitric acid, alkalis, and oxidizers such as liquid chlorine, many fluorides, perchlorates, and other halogens, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No substances are readily identified from composition, but, no degradation data is available		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Benzene and toluene have IDLH (immediately dangerous to life or health) concentrations = 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes.
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Benzene NESHAPS Stripper Tower Feed

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with in chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children and teenagers have a lower resistance to bone marrow poisons.

Studies with pregnant laboratory animals have demonstrated that **benzene** is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic, nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that **mixed xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on **mixed xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity." Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

Benzene NESHAPS Stripper Tower Feed

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity

Ecological effects testing has not been conducted on this material. If spilled, the aromatic naphtha components of this mixture, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. All of its **aromatic hydrocarbon components (benzene, toluene, xylene isomers, and possibly ethylbenzene)** are volatile and might contribute to the creation of atmospheric smog. Toluene has a half-life of from 3 hours to slightly over 1 day when photochemically active hydroxyl radicals are present; and it is very effectively washed out of the atmosphere by rain. Benzene has a half-life of from 4 to 6 hours when photochemically active hydroxyl radicals are present, especially when atmospheres are polluted with nitrogen oxides or sulfur dioxide. Benzene and toluene are very effectively washed out of the atmosphere by rain.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), all the components in the aromatic naphtha portion of this mixture (**benzene, toluene, xylene isomers, and ethylbenzene**) showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), all these component substances showed 24-hour TLms of from 95 ppm to 400 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This water and aromatic naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

**Benzene NESHAPS
Stripper Tower Feed**

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Flammable liquid, n.o.s. (Benzene, Toluene)		
Hazard Class	Class 3: Flammable liquid.	Packing Group(s)	PG II or PG III
		UN/NA ID	UN1993
Reportable Quantity	The Reportable Quantity (RQ) substance components in this product which require DOT HAZMAT bill-of-lading display are Benzene and Toluene .		
Placards		Emergency Response Guide No.	128
		HAZMAT STCC No.	49 101 31
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This product contains the following components in concentrations that might be at or above de minimis levels and they are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 Benzene [CAS No. 71-43-2] concentration: 0.1 to 5% Toluene [CAS No. 108-88-3] concentration: 0 to 4% Xylenes [CAS No. 1330-20-7] concentration: 0 to 3%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which might be present in this material subject to this statute are: Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 0.1 to 5% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 4% 2,2,4-Trimethylpentane (Iso-octane) [CAS No. 540-84-2] (RQ = 1000 lbs. [453.6 kg]) conc.: 0 to 0.2% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 0 to 3% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 0.7% Cumene (Isopropylbenzene) [CAS No. 98-82-8] (RQ = 5000 lbs. [2268 kg]) concentration: 0 to 0.2%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802
California Proposition 65	This material might contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.

Benzene NESHAPS Stripper Tower Feed

Additional Regulatory Remarks

Under Section 12(b) of the Toxic Substances Control Act. Because it may contain detectable amounts of **n-Propylbenzene [CAS No. 103-65-1]** and **other C9 Aromatic Hydrocarbons**, this material might be subject to US EPA's one-time only per country export notification requirements.

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": **Benzene [CAS No. 71-43-2]** and possibly **Toluene [CAS No. 108-88-3]**, **mixed Xylenes [CAS No. 1330-20-7]**, **Ethylbenzene [CAS No. 100-41-4]**, and **Cumene (Isopropylbenzene) [CAS No. 98-82-8]**.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1 0
Revision Date 10/04/1999
Print Date Printed on 10/14/1999.

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0951
HFR# 412

Rich DEA

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0951
Revision Date 9/6/2006

Hazard Rankings

	HMIS	NFPA
Health Hazard	4	4
Fire Hazard	1	1
Reactivity	2	2

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Dark. **Odor** Ammoniacal. Rotten eggs.
(Strong.)

DANGER!

Corrosive. Causes eye and skin burns.

Causes respiratory irritation and can cause damage to respiratory system.

May be harmful or fatal if swallowed.

Aspiration hazard if swallowed -- Can enter lungs and cause damage.

If swallowed, seek medical attention immediately.

Contains Hydrogen Sulfide Gas!

Harmful to aquatic organisms.

Protective Equipment

**Minimum Recommended
See Section 8 for Details**

Minimum PPE reflects the requirements for this material at this facility:
LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Rich aqueous amine solution.	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645. Also see Notes to Physician.
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Refinery Process Chemical		
Synonyms	Aqueous Diethanolamine/Proprietary Amine Solution Containing Hydrogen Sulfide and Ammonia; Rich Amine; Hydrogen Sulfide Extractant Solution; Sour Contactor Solvent Solution.		

SECTION 2. COMPOSITION (TYPICAL)

All liquid components are listed on a weight % basis and all gases are listed on a mole % basis.

Component Name(s)	CAS Registry No.	Concentration (%)
Water	7732-18-5	60 - 70
Proprietary Amines	Mixture	12 - 16
Diethanolamine	111-42-2	18 - 24
Hydrogen Sulfide	7783-06-4	0.5 - 20
Ammonia	7664-41-7	0 - 5

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SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

- Inhalation** Not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of vapor, mist, or liquid droplets may cause respiratory tract irritation, mucous membrane tissue burns, and possibly, chemical pneumonia.
- Eye Contact** Causes irritation, experienced as pain, with excess blinking and tear production, and seen as extreme redness and swelling of the eye and chemical burns of the eye. Severe eye damage may cause blindness. This product contains one or more amines which may produce temporary and reversible hazy or blurred vision. Symptoms disappear when exposure is terminated.
- Skin Contact** Causes severe irritation with pain, redness and swelling, chemical burns, blister formation, and possible tissue destruction. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins.
- Ingestion** May cause mucous membrane irritation or chemical burns to the mouth, throat, and gastrointestinal tract with accompanying nausea, abdominal pain, diarrhea, thirst weakness and collapse. Aspiration may occur during swallowing or vomiting, resulting in lung damage.
- Chronic Health Effects Summary** Repeated skin contact may cause a persistent irritation or dermatitis. Repeated inhalation may cause lung damage.

Conditions Aggravated by Exposure Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin, Respiratory System

Target Organs Not available.

Carcinogenic Potential This product is not known to contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move exposed individual to fresh air. Monitor for respiratory distress. If the individual is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. Persons providing mouth-to-mouth rescue breathing may be placing themselves at risk either from exposure to toxic materials or communicable disease.

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Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with cool water under a shower of water for at least 15 minutes while removing contaminated shoes and clothing. Use cold water. Neutralize exposed skin with a dilute solution of boric acid or acetic acid. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Seek medical attention if tissue appears damaged or if pain or irritation persists. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.
Notes to Physician	<p>INHALATION: Treat as corrosive material. Monitor for pharyngeal and pulmonary edema. Onset may be delayed up to 24 hours from exposure. Administer supplemental oxygen with assisted ventilation, as required.</p> <p>SKIN: Treat as corrosive material. Wash contaminated skin thoroughly with water or saline.</p> <p>INGESTION: Due to the potential for esophageal or gastrointestinal tract burns following ingestion, do not induce emesis. Careful gastric lavage may be considered. Immediate dilution with water or milk may be beneficial. Do not treat with sodium bicarbonate or attempt to neutralize as this can cause exothermic gas generation and, in severe cases, cause perforation.</p> <p>Proprietary amine mixture is UCARSOL (TM) LE SOLVENT 713. Medical Information can be obtained from the Dow Chemical Company at telephone (989) 636-4400.</p>

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	not available
Flash Point	The lowest known value is Open cup: 134°C (273.2°F). (Diethanolamine)
Lower Flammable Limit	No data.
Upper Flammable Limit	No data.
Autoignition Temperature	Not available.
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, and/or unburned hydrocarbons. nitrogen oxides (NO, NO ₂ ...)
Special Properties	This material will release vapors when heated above the flash point temperature that can ignite when exposed to a source of ignition. In enclosed spaces, vapors can ignite with explosive force. Mists or sprays may burn at temperatures below the flash point.
Extinguishing Media	Not expected to present a fire or explosion hazard. Use foam, waterspray, dry chemical, or carbon dioxide (CO ₂) as extinguishing agents should this material become involved in a fire.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

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SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Do not get water inside containers. Minor leaks or spills can be diluted and neutralized with plenty of water. To avoid the evolution of poisonous hydrogen sulfide gas, this acid must not be allowed to contact sulfide wastes (as in sewers). Absorb or cover the neutralized residue with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. Contain large spills to maximize product recovery or disposal. Prevent entry into waterways or sewers. In urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from ecologists to minimize physical habitat damage. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling	Do not breathe vapor or mist. Do not get in eyes, on skin or on clothing. Wash thoroughly after handling.
Storage	Store in glass or other approved containers away from chemicals and combustible materials. Store in a cool, dry, secure and well ventilated area away from sunlight. Keep away from heat, sparks and flame. Keep container tightly closed. Storage area should be equipped with an appropriate chemical resistant floor. Drainage facilities should be constructed for containment of small spills.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls	No special ventilation is required under normal conditions of use. Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Where carbon dioxide or sulfur dioxide may be generated, special ventilation may be required. Ensure that an emergency eye wash station and safety shower are located near the work-station.
Personal Protective Equipment	Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required. Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection	Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Suitable eye wash water should be readily available.
Hand Protection	Avoid skin contact. Disposable neoprene, rubber, or vinyl gloves are required for use. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.

Rich DEA

Body Protection	Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing should be worn. Protective clothing should include long-sleeves, apron, slicker suit, boots and additional facial protection. Use a full-body corrosives suit whenever appropriate. If general contact occurs, IMMEDIATELY get under an emergency shower and remove contaminated clothing. Then take a thorough shower. Contaminated leather goods should be removed immediately and discarded.
Respiratory Protection	For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
General Comments	Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. Do not use gasoline, kerosene, solvents, or harsh abrasive skin cleaners. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Water	Not available.
Diethanolamine	ACGIH TLV (United States). Skin TWA: 2 mg/m ³ 8 hour(s).
	NIOSH (United States). TWA: 3 ppm 8 hour(s).
Hydrogen Sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s).
	OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Ammonia	ACGIH TLV (United States, 2000). TWA: 25 ppm 8 hour(s). ACGIH (United States, 2000). STEL: 35 ppm OSHA (United States, 1989). STEL: 35 ppm TWA: 50 ppm STEL: 35 ppm

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Dark.	Odor	Ammoniacal. Rotten eggs. (Strong.)
Specific Gravity	AP 1	pH	AP 9.5	Vapor Density	AP 1.4
Boiling Range	The lowest known value is 100°C (212°F) (Water).		Melting/Freezing Point	Not available.	
Vapor Pressure	Not available.		Volatility	Slightly volatile.	
Solubility in Water	Easily soluble in cold water. Soluble in hot water, methanol, diethyl ether.		Viscosity (cSt @ 40°C)	not available	
Flash Point	The lowest known value is Open cup: 134°C (273.2°F). (Diethanolamine)				
Additional Properties	No additional information.				

Rich DEA

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization Not expected to occur.
Conditions to Avoid	Keep away from strong acids, heat and hot surfaces, strong oxidizing conditions, and severe agitation. Contact with some metals can generate extremely flammable hydrogen (H ₂) gas. Avoid direct contact with organic halogen compounds.	
Materials Incompatibility	This material is incompatible with acids and oxidizers.	
Hazardous Decomposition Products	Toxic levels of ammonia, oxides of nitrogen, carbon monoxide, carbon dioxide, irritating aldehydes and ketones may be formed on burning in a limited air supply.	

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Diethanolamine ORAL (LD50):	Acute: 3300 mg/kg [Mouse]. 2200 mg/kg [Rabbit].
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Standard Draize Test:
Skin (rabbit) 500 mg/24H - Mild
Eye (rabbit) 750 ug/24H - Severe

In studies conducted by National Toxicology Program (NTP), F344/N male and female rats were dermally administered diethanolamine in ethanol at various doses for 2 years. In addition, B6C3F1 mice were dermally administered diethanolamine in ethanol at various dose levels for 2 years. NTP concluded that, under the conditions of these studies, there was no evidence of carcinogenic activity of diethanolamine in either sex of F344/N rats. Also, NTP determined that there was clear evidence of carcinogenic activity of diethanolamine in mice based on an increased incidence of liver neoplasms in males and females and increased incidences of renal tubule neoplasms in males. The significance of these findings to humans is unclear.

Hydrogen Sulfide
INHALATION (LC50): Acute: 444 ppm 1 hour(s) [Rat]. 673 ppm 1 hour(s) [Mouse].
Hydrogen Sulfide (H₂S) has an unpleasant odor that diminishes with increased concentrations. Eye irritation can occur at concentrations above four ppm. Olfactory fatigue occurs rapidly at concentrations above 50. Accordingly, odor is not a reliable warning property. Symptoms increase with exposures above 50 ppm. Respiratory effects including irritation with possible pulmonary edema can occur with exposure above 50 ppm. At concentrations above 500 ppm, an immediate loss of consciousness, depressed respiration and death can occur. NIOSH has determined that H₂S concentrations at or above 100 ppm are immediately dangerous to life and health.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Vapor releases from this material are expected to cause significant immediate impact but only localized non-persistent environmental damage. Due caution should be exercised to prevent an accidental release into the environment. This material and any contaminated soil or other water may be hazardous to human, animal, and aquatic life.
Environmental Fate	This product is miscible in water and is expected to readily disperse in marine environments.

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SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovery and reuse, rather than disposal, should be the ultimate goal for handling this corrosive alkaline material. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Hydrogen sulfide, CAS Number, 7783-06-4 Concentration: 10.25% , CAS Number, 7664-41-7 Concentration: 2.5%
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above <i>de minimis</i> levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Diethanolamine [CAS No.: 111-42-2] Concentration: 32.5% Hydrogen sulfide [CAS No.: 7783-06-4] Concentration: 10.3%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Diethanolamine [CAS No.: 111-42-2] RQ = 100 lbs. (45.36 kg) Concentration: 32.5% Hydrogen sulfide [CAS No.: 7783-06-4] RQ = 100 lbs. (45.36 kg) Concentration: 10.3% [CAS No.: 7664-41-7] RQ = 100 lbs. (45.36 kg) Concentration: 2.5%

Rich DEA**Clean Water Act
(CWA)**

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

**California
Proposition 65**

This product is not known to contain any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.

**New Jersey
Right-to-Know Label**

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

**Additional Regulatory
Remarks****SECTION 16. OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3.0
Revision Date 9/6/2006
Print Date Printed on 9/6/2006.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS0952
HFR# 210

Lean DEA

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0952
Revision Date 9/6/2006

Hazard Rankings

	HMIS	NFPA
Health Hazard	2	2
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.

Color Dark. **Odor** Slight.

DANGER!

Corrosive. Causes eye and skin burns.

Causes respiratory irritation and can cause damage to respiratory system.

May be harmful or fatal if swallowed.

Aspiration hazard if swallowed -- Can enter lungs and cause damage.

If swallowed, seek medical attention immediately.

Contains Hydrogen Sulfide Gas!

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Lean aqueous amine solution	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645 Also see Notes to Physician.
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Refinery Process Chemical		
Synonyms	Aqueous Diethanolamine Solution/Proprietary Amine mixture Containing Trace Amounts of Hydrogen Sulfide and Ammonia; Lean Amine; Steam-stripped Amine Solution; Stripped Amine Solution; H ₂ S/NH ₃ Extractant Solution; Sour Contactor Solvent Solution; Effluent from the Amine Stripper Tower.		

SECTION 2. COMPOSITION (TYPICAL)

All liquids are listed on a weight % basis.

Component Name(s)	CAS Registry No.	Concentration (%)
Water	7732-18-5	60 - 70
Diethanolamine	111-42-2	18 - 24
Hydrogen Sulfide	7783-06-4	0 - 0.05
Ammonia	7664-41-7	0 - 0.005
Proprietary Amines	Mixture	12 - 16

Lean DEA

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

Inhalation	Not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of vapor, mist, or liquid droplets may cause respiratory tract irritation, mucous membrane tissue burns, and possibly, chemical pneumonia.
Eye Contact	Causes irritation, experienced as pain, with excess blinking and tear production, and seen as extreme redness and swelling of the eye and chemical burns of the eye. Severe eye damage may cause blindness. This product contains one or more amines which may produce temporary and reversible hazy or blurred vision. Symptoms disappear when exposure is terminated.
Skin Contact	Causes severe irritation with pain, redness and swelling, chemical burns, blister formation, and possible tissue destruction. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins.
Ingestion	May cause mucous membrane irritation or chemical burns to the mouth, throat, and gastrointestinal tract with accompanying nausea, abdominal pain, diarrhea, thirst weakness and collapse. Aspiration may occur during swallowing or vomiting, resulting in lung damage.
Chronic Health Effects Summary	Repeated skin contact may cause a persistent irritation or dermatitis. Repeated inhalation may cause lung damage.
Conditions Aggravated by Exposure	Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin, Respiratory System
Target Organs	Not available.
Carcinogenic Potential	This product is not known to contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification			OSHA Physical Hazard Classification						
Irritant	<input checked="" type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress. If the individual is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. Persons providing mouth-to-mouth rescue breathing may be placing themselves at risk either from exposure to toxic materials or communicable disease.
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Lean DEA

Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with cool water under a shower of water for at least 15 minutes while removing contaminated shoes and clothing. Use cold water. Neutralize exposed skin with a dilute solution of boric acid or acetic acid. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Seek medical attention if tissue appears damaged or if pain or irritation persists. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.
Notes to Physician	<p>INHALATION: Treat as corrosive material. Monitor for pharyngeal and pulmonary edema. Onset may be delayed up to 24 hours from exposure. Administer supplemental oxygen with assisted ventilation, as required.</p> <p>SKIN: Treat as corrosive material. Wash contaminated skin thoroughly with water or saline.</p> <p>INGESTION: Due to the potential for esophageal or gastrointestinal tract burns following ingestion, do not induce emesis. Careful gastric lavage may be considered. Immediate dilution with water or milk may be beneficial. Do not treat with sodium bicarbonate or attempt to neutralize as this can cause exothermic gas generation and, in severe cases, cause perforation.</p> <p>The proprietary amine mixture is UCARSOL (TM) LE SOLVENT 713. Medical Information can be obtained from The Dow Chemical Company at telephone (989) 636-4400.</p>

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	not available
Flash Point	The lowest known value is Open cup: 134°C (273.2°F). (Diethanolamine)
Lower Flammable Limit	No data.
Upper Flammable Limit	No data.
Autoignition Temperature	Not available.
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, and/or unburned hydrocarbons. nitrogen oxides (NO, NO ₂ ...)
Special Properties	This material will release vapors when heated above the flash point temperature that can ignite when exposed to a source of ignition. In enclosed spaces, vapors can ignite with explosive force. Mists or sprays may burn at temperatures below the flash point.
Extinguishing Media	Not expected to present a fire or explosion hazard. Use foam, waterspray, dry chemical, or carbon dioxide (CO ₂) as extinguishing agents should this material become involved in a fire.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

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SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Do not get water inside containers. Minor leaks or spills can be diluted and neutralized with plenty of water. To avoid the evolution of poisonous hydrogen sulfide gas, this acid must not be allowed to contact sulfide wastes (as in sewers). Absorb or cover the neutralized residue with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. Contain large spills to maximize product recovery or disposal. Prevent entry into waterways or sewers. In urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from ecologists to minimize physical habitat damage. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling	Do not breathe vapor or mist. Do not get in eyes, on skin or on clothing. Wash thoroughly after handling.
Storage	Store in glass or other approved containers away from chemicals and combustible materials. Store in a cool, dry, secure and well ventilated area away from sunlight. Keep away from heat, sparks and flame. Keep container tightly closed. Storage area should be equipped with an appropriate chemical resistant floor. Drainage facilities should be constructed for containment of small spills.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls	No special ventilation is required under normal conditions of use. Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Where carbon dioxide or sulfur dioxide may be generated, special ventilation may be required. Ensure that an emergency eye wash station and safety shower are located near the work-station.
Personal Protective Equipment	Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required. Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection	Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Suitable eye wash water should be readily available.
Hand Protection	Avoid skin contact. Disposable neoprene, rubber, or vinyl gloves are required for use. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.

Lean DEA

Body Protection	Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing should be worn. Protective clothing should include long-sleeves, apron, slicker suit, boots and additional facial protection. Use a full-body corrosives suit whenever appropriate. If general contact occurs, IMMEDIATELY get under an emergency shower and remove contaminated clothing. Then take a thorough shower. Contaminated leather goods should be removed immediately and discarded.
Respiratory Protection	For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
General Comments	Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. Do not use gasoline, kerosene, solvents, or harsh abrasive skin cleaners. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Water	Not available.
Diethanolamine	ACGIH TLV (United States). Skin TWA: 2 mg/m ³ 8 hour(s). NIOSH (United States). TWA: 3 ppm 8 hour(s).
Hydrogen Sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Ammonia	ACGIH TLV (United States, 2000). TWA: 25 ppm 8 hour(s). ACGIH (United States, 2000). STEL: 35 ppm OSHA (United States, 1989). STEL: 35 ppm TWA: 50 ppm STEL: 35 ppm

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Dark.	Odor	Slight.
Specific Gravity	AP 1	pH	AP 9.5	Vapor Density	AP 1.4
Boiling Range	The lowest known value is 100°C (212°F) (Water).	Melting/Freezing Point			Not available.
Vapor Pressure	Not available.	Volatility			Slightly volatile.
Solubility in Water	Easily soluble in cold water. Soluble in hot water, methanol, diethyl ether.	Viscosity (cSt @ 40°C)			not available
Flash Point	The lowest known value is Open cup: 134°C (273.2°F). (Diethanolamine)				
Additional Properties	No additional information.				

Lean DEA

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization Not expected to occur.
Conditions to Avoid	Keep away from strong acids, heat and hot surfaces, strong oxidizing conditions, and severe agitation. Contact with some metals can generate extremely flammable hydrogen (H ₂) gas. Avoid direct contact with organic halogen compounds.	
Materials Incompatibility	This material is incompatible with acids and oxidizers.	
Hazardous Decomposition Products	Toxic levels of ammonia, oxides of nitrogen, carbon monoxide, carbon dioxide, irritating aldehydes and ketones may be formed on burning in a limited air supply.	

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Diethanolamine

ORAL (LD50): Acute: 3300 mg/kg [Mouse]. 2200 mg/kg [Rabbit].

Standard Draize Test:

Skin (rabbit) 500 mg/24H - Mild

Eye (rabbit) 750 ug/24H - Severe

In studies conducted by National Toxicology Program (NTP), F344/N male and female rats were dermally administered diethanolamine in ethanol at various doses for 2 years. In addition, B6C3F1 mice were dermally administered diethanolamine in ethanol at various dose levels for 2 years. NTP concluded that, under the conditions of these studies, there was no evidence of carcinogenic activity of diethanolamine in either sex of F344/N rats. Also, NTP determined that there was clear evidence of carcinogenic activity of diethanolamine in mice based on an increased incidence of liver neoplasms in males and females and increased incidences of renal tubule neoplasms in males. The significance of these findings of humans is unclear.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Vapor releases from this material are expected to cause significant immediate impact but only localized non-persistent environmental damage. Due caution should be exercised to prevent an accidental release into the environment. This material and any contaminated soil or other water may be hazardous to human, animal, and aquatic life.
Environmental Fate	This product is miscible in water and is expected to readily disperse in marine environments.

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SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovery and reuse, rather than disposal, should be the ultimate goal for handling this corrosive alkaline material. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above <i>de minimis</i> levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Diethanolamine [CAS No.: 111-42-2] Concentration: 22.5%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Diethanolamine [CAS No.: 111-42-2] RQ = 100 lbs. (45.36 kg) Concentration: 22.5%
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

Lean DEA**California
Proposition 65**

This product is not known to contain any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.

**New Jersey
Right-to-Know Label**

For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.

**Additional Regulatory
Remarks****SECTION 16. OTHER INFORMATION**

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 2.0
Revision Date 9/6/2006
Print Date Printed on 9/6/2006.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Establishe
ACGIH: American Conference of Governmental Industrial Hygienist:				AIHA: American Industrial Hygiene Associator		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

Light Aromatics (BTX) Plus Sulfolane

Material Safety Data Sheet

Company

Houston Refining
One Houston Center, Suite 700
1221 McKinney St.
P.O. Box 2583
Houston, Texas 77252-2583

MSDS No. RS0963
Revision Date 11/01/06

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Liquid.		
Color	Hazy grey to black	Odor	Characteristic, sweet and pleasant, aromatic hydrocarbon. Its odor threshold is 2-5 ppm in air.

WARNING! Flammable liquid; vapor may cause flash fire!
Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract!
Liquid contact may cause minimal to moderate eye and/or minimal to severe skin irritation and inflammation!
May be harmful if inhaled or absorbed through the skin!
Overexposures may cause central nervous system (CNS) depression and target organ effects such as hearing loss and/or liver, blood, and blood-forming tissue damage!
May be harmful or fatal if ingested!
Aspiration into the lungs can cause pulmonary edema and chemical pneumonia!
Prolonged and/or repeated inhalation may increase the heart's susceptibility to arrhythmias (irregular beats)!
Contains Benzene! Cancer hazard; may cause leukemia and other blood disorders! Mutagenic hazard; may cause genetic damage!
Based upon animal testing, may adversely affect reproduction!
Spills may create a slipping hazard!

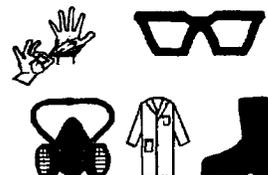
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Light Aromatics (BTX) Plus Sulfolane
Product Number	0222222205
CAS Number	Mixture
Product Family	C6-C9 Aromatic Hydrocarbons in Hydrothiophene Dioxide Extraction Solvent
Synonyms	Rich Sulfolane; C6-C9 Aromatic Hydrocarbons and Sulfolane, Sulfolane Extract containing Light Aromatic Naphtha, Tetrahydrothiophene-1,1-Dioxide saturated with BTX Aromatics

Business Contact

Product Safety 800-700-0946

24 Hour Emergency Contact

CHEMTREC	800-424-9300
CANUTEC-Canada	613-996-6666
LYONDELL	800-245-4532

**Light Aromatics (BTX)
Plus Sulfolane**

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Tetrahydrothiophene-1,1-dioxide (Sulfolane)	126-33-0	35-84
2) Benzene	71-43-2	10-25
3) Toluene	108-88-3	5-20
4) Xylene, Mixed Isomers	1330-20-7	1-10
5) Ethylbenzene	100-41-4	0-3
6) n-Propylbenzene	103-65-1	0-2
7) Water	7732-18-5	0-3

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon level of exposure concentration and/or duration. Vapors can reduce the oxygen content in air. Approximately 20,000 ppm (or 2 vol.%) in air is fatal to humans in 5 to 10 minutes. Sudden death from cardiac arrest (heart attack) may result from an exposure of 10,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	Animal test results and actual human exposures of this material's components suggest that this product can cause minimal to moderate eye irritation upon short-term exposure. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	Animal test results and actual human exposures of this material's components suggest that this product can cause minimal to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause moderate to severe dermatitis. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and severe tissue damage.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, abdominal pain, vomiting, jaundice (yellowing of skin color), dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration can result in severe lung damage or death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary Chronic occupational xylene exposures have caused auditory nerve degeneration. Prolonged exposure and/or overexposures to sulfolane (tetrahydrothiophene-1,1-dioxide) may cause damage to the liver, white blood cells, and/or central nervous system. Also, chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

Reports have associated repeated and prolonged occupational overexposure to solvents with irreversible brain and nervous system damage (sometimes referred to as "Solvent or Painter's Syndrome"). Also, altered mental state, drowsiness, menstrual problems, peripheral motor neuropathy, irreversible brain damage (so-called "Petrol Sniffers Encephalopathy"), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers. Intentional misuse by deliberately concentrating and inhaling this product may be harmful or fatal.

Available information indicates that toluene is NOT teratogenic, but it can be toxic to the embryo and fetus and may reduce fertility. In animal tests, high inhaled doses of toluene has caused reduced litter sizes, retarded development of the fetus, and increased incidence of non-lethal abnormalities.

Light Aromatics (BTX) Plus Sulfolane

Benzene is considered to be a cancer causing agent. It damages blood cells, the bone marrow, and other blood-forming tissues causing leukopenia, aplastic anemia, and/or acute myelogenous leukemia (AML). Benzene is also capable of causing changes in genetic material (chromosomes). Chronic overexposures have caused vaginal bleeding, heavy menstrual bleeding, and hemorrhagic complications during pregnancy. Available information indicates that benzene is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. In limited animal tests, high inhaled doses of benzene have caused decreased fetal body weights, increased skeletal variations, and alterations in the formation and development of blood cells in the bone marrow of rodents.

Based upon animal testing, the C8 aromatic hydrocarbon components (xylenes and ethylbenzene) might be assumed to cause embryo and fetal toxicity, spontaneous abortions, and/or decreased fetal and newborn weights if overexposures occur during a woman's early gestation period. (See Section 11)

Conditions Aggravated by Exposure

Personnel with pre-existing central nervous system (CNS) disease, neurological conditions, skin disorders, impaired hearing, liver, or kidney function, blood disorders, or chronic respiratory diseases, and women attempting to conceive should avoid exposure. Special precautions are necessary for pregnant women and nursing mothers.

Exposure to high concentrations of this material may increase the sensitivity of the heart to epinephrine (adrenalin) and catecholamine-like drugs. Personnel with pre-existing cardiac disorders may be more susceptible to this effect (see Section 4, "Note to Physicians").

Target Organs

This substance is toxic to lungs, central nervous system, especially the auditory nerve, brain, mucous membranes, skin, eyes, and possibly, the blood, bone marrow and other blood-forming tissues, heart, liver, kidneys, thymus, and reproductive systems.

Carcinogenic Potential

This product contains a benzene component at concentrations at or above 0.1%. Benzene is considered carcinogenic by OSHA, IARC, and NTP. See Section 11.

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation

Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

Eye Contact

Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

Skin Contact

Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion

Do not induce vomiting or give anything by mouth. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

**Light Aromatics (BTX)
Plus Sulfolane**

Notes to Physician

Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Administer an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	OSHA/NFPA Class-IB, IC, or II Flammable Liquid. Highly or moderately flammable!		
Flash Point/Method	CLOSED CUP: 4° to 60°C (40° to 140°F) (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.0%	Upper Flammable Limit	AP 7.1%
Auto-Ignition Temp.	AP 432°C (810°F)		
Hazardous Combustion Products	Burning or excessive heating may produce smoke, carbon monoxide, carbon dioxide, sulfur oxides, and possibly hydrogen sulfide.		
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE Use dry chemicals, carbon dioxide (CO ₂), foam, water fog, or inert gas (nitrogen). LARGE FIRE Use foam, water fog, or waterspray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, autoignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.		
Fire Fighting Protective Clothing	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

Light Aromatics (BTX) Plus Sulfolane

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room, and preferably refrigerated. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the N.F.P.A.'s National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact and use gloves (disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Light Aromatics (BTX) Plus Sulfolane

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

Warning! Odor is an inadequate warning for hazardous conditions, especially since the odor threshold of benzene is several ppm above the occupational exposure guideline levels. Released vapors may cause extremely flammable, explosive, and/or oxygen-deficient atmospheres. Do not enter such areas or confined spaces without taking special safety precautions including monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Oil mist, mineral	TWA: 5 STEL 10 (mg/M ³) from ACGIH (TLV) [1999] TWA: 5 (mg/M ³) from OSHA (PEL) [1976]
2) Benzene ("A1" and "Z-2" Carcinogen)	TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 1 STEL: 5 AL 0.5 (ppm) from OSHA (PEL) [1987] - SKIN
3) Toluene ("A4" = Not Classifiable)	TWA: 50 (ppm) from ACGIH (TLV) [1999] - SKIN TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989] TWA: 200 CEIL: 300 (ppm) from OSHA (PEL) [1976]
4) Xylene, Mixed Isomers ("A4" = Not Classifiable)	TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 150 (ppm) from OSHA (PEL) [1989]
5) Ethylbenzene ("A3" Animal Carcinogen proposed for 2000.)	TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [1999] TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid.	Color	Hazy grey to black	Odor	Characteristic, sweet and pleasant, aromatic hydrocarbon Its odor threshold is 2-5 ppm in air.
Specific Gravity	0.89-0.99 (Water = 1)	pH	Not applicable	Vapor Density	3.4 to 4.2 (Ar = 1)
Boiling Point/Range	80° to 285°C (176° to 545°F)			Melting/Freezing Point	-95° to 10°C (-139° to 50°F)
Vapor Pressure	23 to 43 mm Hg at 20°C (68°F)			Viscosity (cSt @ 40°C)	2 to 4
Solubility in Water	Significantly soluble in cold water (35 to 85%); miscible with most organic solvents.			Volatile Characteristics	Volatile Organic Compounds (VOCs) Content = 16 to 60%; AP 875 gm/L.
Additional Properties	C6-C9 Aromatic Hydrocarbon Content = 16 to 60 Wt % (ASTM D-1319); Alkane, Isoparaffin, and Cycloalkane Hydrocarbons Content = LT 1 Wt % (ASTM D-1319); Average Density at 60°F = 7.828 lbs./gal (ASTM D-2161); Dry Point Temperature = 545°F (285°C) (ASTM D-86)				

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from heat, sparks, and other ignition sources, strong oxidizing conditions, and freezing temperatures.		
Materials Incompatibility	Strong acids, especially nitric acid, alkalis, and oxidizers such as liquid chlorine, many fluorides, perchlorates, and other halogens, hydrogen peroxide, and oxygen		
Hazardous Decomposition Products	Sulfur oxides and possibly hydrogen sulfide; but, no degradation data is available. Toxic sulfur dioxide will be given off of sulfolane if it is heated above 220°C (428°F).		

Light Aromatics (BTX)
Plus Sulfolane

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Sulfolane (Tetrahydrothiophene-1,1-dioxide):

ORAL (LD50): Acute: 1,500 to 5,000 mg/kg or [Rat].
GAS (LC50): Acute: GT 12,000 mg/m³ for 4 hours [Rat screen level]
DERMAL (LD50): Acute: GT 2,000 mg/kg [Rabbit screen level].

Benzene:

ORAL (LD50): Acute: 930 mg/kg [Rat] - Tremors and convulsions.
ORAL (LD50): Acute: 4,700 mg/kg [Mouse].
ORAL (LD50): Acute: 5,700 mg/kg [Unidentified mammal]
GAS (LC50): Acute: 10,000 ppm for 7 hours [Rat]
GAS (LC50): Acute: 9,980 ppm for 8 hours [Mouse] - General anesthesia, muscle weakness, and dyspnea

DERMAL (LD50): Acute: 48 mg/kg [Mouse].
DERMAL (LD50): Acute: GT 9,400 uL/kg [Rabbit and Guinea Pig].
INTRAPERITONEAL (LD50) Acute: 340 mg/kg [Mouse]
INTRAPERITONEAL (LD50): Acute: 2,890 ug/kg [Rat] - Lung and liver damage plus decreased blood cells

Toluene:

ORAL (LD50): Acute: 636 mg/kg or [Rat]
ORAL (LD50): Acute: 4,000 mg/kg or [Cat]
GAS (LC50): Acute: 49,000 mg/m³ for 4 hours [Rat]
GAS (LC50): Acute: 5,320 ppm for 8 hours [Mouse].
GAS (LC50): Acute: 400 ppm for 24 hours [Mouse].
DERMAL (LD50): Acute: 14,100 uL/kg or 12,125 mg/kg [Rabbit]
INTRAVENOUS (LD50). Acute: 1,960 mg/kg [Rat].
INTRAVENOUS (LD50) Acute: 2,000 mg/kg [Mouse].
SUBCUTANEOUS (LD50): Acute: 2,250 mg/kg [Mouse].
INTRAPERITONEAL (LD50): Acute: 59 mg/kg [Mouse]
INTRAPERITONEAL (LD50): Acute: 500 mg/kg [Guinea Pig].
INTRAPERITONEAL (LD50): Acute: 1,332 mg/kg [Rat].

Xylenes:

ORAL (LD50): Acute: 4,300 mg/kg [Rat].
GAS (LC50): Acute: 4,550 ppm for 4 hours [Rat]
DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit].
SUBCUTANEOUS (LD50): Acute: 1,700 mg/kg [Rat]
INTRAPERITONEAL (LD50): Acute: 2,459 mg/kg [Rat]
INTRAPERITONEAL (LD50): Acute: 1,548 mg/kg [Mouse].

Ethylbenzene:

ORAL (LD50): Acute: 3,500 mg/kg [Rat]
DERMAL (LD50): Acute: 17,800 uL/kg [Rabbit].
INTRAPERITONEAL (LD50): Acute: 2,624 mg/kg [Rat].

n-Propylbenzene:

ORAL (LD50): Acute: 6,040 mg/kg [Rat].
GAS (LC50): Acute: 65,000 ppm for 2 hours [Rat]

Results from repeated inhalation exposure (8 hours/day for up to 27 days) to an aerosolized sulfolane concentration of 495 mg/m³ showed pale-colored hearts and livers with fatty metamorphosis of the liver (monkeys), chronic liver inflammation (rats), chronic lung inflammation (monkeys, dogs, rats, and Guinea pigs), vomiting and convulsions (monkeys and dogs), decreased white blood cell counts (monkeys and rats), and deaths (monkeys). Acute inhalation overexposures and longer continuous exposures at various lower concentrations showed similar adverse effects, but without deaths. The "no observed effect level (NOEL)" for sulfolane was noted to be 20 mg/m³. Sulfolane showed no evidence of mutagenic activity using an assorted battery of testing protocols.

Benzene and toluene have IDLH (immediately dangerous to life or health) concentrations = 500 ppm. Its estimated lethal dose for a normal human adult is one teaspoon to one ounce (AP 10 mL). Inhalation of 20,000 ppm in air is lethal to adults in 5 to 10 minutes.

Light Aromatics (BTX) Plus Sulfolane

Benzene is a known animal carcinogen and a human leukemogen. In addition, NTP, IARC, EPA, OSHA, and ACGIH list benzene as a "Human Carcinogen." Repeated and prolonged overexposure to benzene vapors (GT 20 ppm in air) may cause toxicity to blood-forming tissues. Chronic exposure symptoms include decreased blood cell and platelet counts, leukopenia, aplastic anemia, or acute myelogenous leukemia (AML). Also, chronic inhalation of benzene vapors have been found to cause fatigue, nervousness, irritability, blurred vision, and labored breathing. Overexposure to benzene has been associated with chromosomal aberrations in human white blood cells, both laboratory animal and human bone marrow cell damage, and in vitro mammalian cells DNA damage. Elevated frequencies of chromosomal aberrations have been observed in peripheral white blood cells and bone marrow of workers exposed to high benzene concentrations known to be associated with signs of chronic poisoning. Ethanol consumption may have a synergistic effect and increase blood system changes caused by benzene exposures. Children and teenagers have a lower resistance to bone marrow poisons.

Studies with pregnant laboratory animals have demonstrated that **benzene** is NOT teratogenic, but is fetotoxic at exposure levels which result in mild maternal toxicity. There are also reports of human benzene exposure inducing vaginal bleeding, menstrual cycle disorders, and hemorrhagic complications during pregnancy. Benzene can be detected in maternal milk and it passes through the placental barrier. Limited evidence of developmental toxicity are suggested by decreased fetal body weight and increased skeletal variations in rodents. Also, alterations in the formation and development of blood cells in the bone marrow were observed in the fetus and offspring of pregnant mice.

Toluene (methylbenzene) has been a major solvent of intentional inhalation abuse. Deliberate long-term inhalation of high concentrations of toluene (glue sniffing, etc.) has been shown to cause liver, kidney, central nervous system, and permanent brain damage. Effects such as impaired speech, visual disturbances, and hearing loss, loss of balance and/or muscle control, and memory loss have been reported. Exposures of 100 to 200 ppm in air for 24 hours cause hallucinations, distorted perceptions, and changes in motor activity. Studies have indicated that children of women who sniffed massive exposures of toluene during pregnancy are at significant risk for pre-term delivery, perinatal death, growth retardation, and other adverse developmental effects. Isolated case reports have suggested a spectrum of congenital defects similar to those seen in fetal alcohol (ethanol) syndrome. These children's defects included microcephaly (small head size), central nervous system (CNS) deficiencies, facial abnormalities, and reduced growth rate.

Animal studies suggest that **toluene** causes kidney, liver, and/or lung dysfunction and cardiac (heart muscle) sensitization to epinephrine or other adrenalin-like agents. This sensitization may cause fatal changes in heart beat rhythms. Also, this latter effect was shown to be enhanced by hypoxia (oxygen deficiency).

Long-term rodent inhalation studies with **toluene** produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness, and impaired reaction time. Also, rats exposed to 1,200 ppm and 1,400 ppm of toluene in air for 14 hours per day for 5 or 4 weeks (respectively) exhibited high-frequency hearing loss. Several animal studies using pregnant rodents have shown that toluene exposures may cause embryo and/or fetotoxicity. Adverse effects included decreased fetal body weight and increased skeletal variations. In chronic feeding and inhalation studies, toluene has not been shown to be carcinogenic, nor is it mutagenic in the Salmonella/microsome (Ames) assay, the in-vivo rat bone marrow cell chromosome aberrations assay, the in-vitro mouse lymphoma assay, 8-week dominant lethal assay, and the in-vitro human adult male lymphocyte sister chromatid exchanges assay. The significance of these animal study results to humans is not known.

An inhalation study with laboratory animals indicated an association of **xylene** with hearing loss in rats. Several animal studies using pregnant rodents have shown that mixed **xylene isomers (dimethylbenzenes)** may all cause embryo and/or fetotoxicity. Inhalation and feeding studies involving pregnant laboratory animals have produced limited evidence of fetal toxicity including increased incidence of spontaneous abortions, decreased fetal weight, delayed bone development, non-lethal abnormalities such as musculoskeletal and craniofacial variations, and reduced litter sizes.

Chronic overexposure to **xylene** may produce irreversible damage to the central nervous system, including ototoxicity, that can be increased by the consumption of ethanol (alcoholic drinks). Drinking beverages which contain ethanol in conjunction with xylene exposure increases the alcoholic effects and impairs the clearance of xylenes from the body. Xylene isomers accumulate in the adipose (fat) tissues, from which they are slowly released. Complete clearance may take several days following exposure.

Two-year rat and mouse gavage studies by the National Toxicology Program (NTP) on mixed **xylene isomers including 17% ethylbenzene** showed "no evidence of carcinogenicity." Also, a two-year mixed xylenes skin-painting study on shaved rats and mice showed no incidence of non-neoplastic or neoplastic lesions. And, none of the components were mutagenic when tested in either the modified Ames, Chinese hamster ovary cell with and without metabolic activation, or sister-chromatid mutagenicity assays.

**Light Aromatics (BTX)
Plus Sulfolane**

The National Toxicology Program (NTP) recently completed a 2-year inhalation bioassay on ethylbenzene in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200, and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Hyperplasia was also observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. NTP, IARC, and OSHA have not designated ethylbenzene as a carcinogen.

SECTION 12: ECOLOGICAL INFORMATION**Ecotoxicity**

Ecological effects testing has not been conducted on this material. If spilled, the aromatic naphtha components of this mixture, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. All of its aromatic hydrocarbon components (benzene, toluene, xylene isomers, and ethylbenzene) are volatile and might contribute to the creation of atmospheric smog. Toluene has a half-life of from 3 hours to slightly over 1 day when photochemically active hydroxyl radicals are present; and it is very effectively washed out of the atmosphere by rain. Benzene has a half-life of from 4 to 6 hours when photochemically active hydroxyl radicals are present, especially when atmospheres are polluted with nitrogen oxides or sulfur dioxide. Benzene and toluene are very effectively washed out of the atmosphere by rain.

Sulfolane dissolves rapidly in water and is practically non-toxic to freshwater fish and aquatic algae. It is only slightly toxic to aquatic invertebrates. Unacclimated bacterial activated sludge systems can accept a shock loading of 200 mg/L of sulfolane and it is ultimately biodegradable. It does not bioaccumulate.

Using Rainbow Trout (*Oncorhynchus mykiss*) and Dungeness Crab (*Cancer magister*), all the components in the aromatic naphtha portion of this mixture (benzene, toluene, xylene isomers, and ethylbenzene) showed a 96-hour TLms (Median Toxic Limit) of from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 10 ppm to 60 ppm when using Bluegill Sunfish (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), and Guppy (*Lebistes reticulatus*) in fresh water. Using Water Fleas (*Daphnia magna*), all these component substances showed 24-hour TLms of from 95 ppm to 400 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.

Environmental Fate

This aromatic naphtha mixture is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a naphtha hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase. This material is biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this naphtha, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floc formation and sludge settling and also plug filters or exchange beds. Vapor emissions from a bio-oxidation process contaminated by this material might prove to be a health hazard.

Light Aromatics (BTX) Plus Sulfolane

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT).		
Proper Shipping Name	Petroleum distillates, n.o.s. (Benzene, Toluene)		
Hazard Class	Class 3: Flammable liquid	Packing Group(s)	PG II
		UN/NA ID	UN1268
Reportable Quantity	The Reportable Quantity (RQ) substance components in this product which require DOT HAZMAT bill-of-lading display are Benzene and Toluene		
Placards		Emergency Response Guide No.	130 or 128
		HAZMAT STCC No.	49 102 56
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1989 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire Hazard, Acute (Immediate) Health Hazard, and Chronic (Delayed) Health Hazard.
SARA 313	This product contains the following components in concentrations at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Benzene [CAS No. 71-43-2] concentration: 10 to 25% Toluene [CAS No. 108-88-3] concentration: 5 to 20% Xylenes [CAS No. 1330-20-7] concentration: 1 to 10% Ethylbenzene [CAS No. 100-41-4] concentration: 0 to 3%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product subject to this statute are: Benzene [CAS No. 71-43-2] (RQ = 10 lbs. [4.54 kg]) concentration: 10 to 25% Toluene [CAS No. 108-88-3] (RQ = 1000 lbs. [453.6 kg]) concentration: 5 to 20% Xylenes [CAS No. 1330-20-7] (RQ = 100 lbs. [45.36 kg]) concentration: 1 to 10% Ethylbenzene [CAS No. 100-41-4] (RQ = 1000 lbs. [453.6 kg]) concentration: 0 to 3%.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

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Light Aromatics (BTX) Plus Sulfolane

**California
Proposition 65**

This material might contain the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it is subject to requirements of California Health & Safety Code Section 25249.5: Benzene [CAS No. 71-43-2] and Toluene [CAS No. 108-88-3].

**New Jersey
Right-to-Know Label**

For New Jersey labeling refer to components listed in Section 2.

**Additional Regulatory
Remarks**

Under the Federal Hazardous Substances Act, related statutes, and Consumer Product Safety Commission regulations, as defined by 16 CFR 1500.14(b)(3) and 1500.83(a)(13). This product contains "Petroleum Distillates" which may require special labeling if distributed in a manner intended or packaged in a form suitable for use in the household or by children. Precautionary label dialogue should display the following **Contains Petroleum Distillates! May be harmful or fatal if swallowed! Keep Out of Reach of Children!**

Under Section 12(b) of the Toxic Substances Control Act: Because it contains **Tetrahydrothiophene-1,1-dioxide (Sulfolane) [CAS No. 126-33-0]** and detectable amounts of **n-Propylbenzene [CAS No. 103-65-1]** and other C9 Aromatic Hydrocarbons, this material might be subject to US EPA's one-time only per country export notification requirements

In regulations promulgated pursuant to the Clean Air Act - Section 111 "Standards of Performance for New Stationary Sources" (40 CFR 60.489), the EPA classifies the following minor components of this material as "Volatile Organic Compounds (VOCs)" which contribute significantly to air pollution which endangers public health and welfare": Benzene [CAS No. 71-43-2], Toluene [CAS No. 108-88-3], mixed Xylenes [CAS No. 1330-20-7], and Ethylbenzene [CAS No. 100-41-4].

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION Logo and Manufacturer name change.

Version Number 2.1

Revision Date 11/01/06

ABBREVIATIONS

AP = Approximately Established EQ = Equal GT = Greater Than LT = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists

AIHA = American Industrial Hygiene Association

IARC = International Agency for Research on Cancer

NTP = National Toxicology Program

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

NPCA = National Paint and Coating Manufacturers Association

HMIS = Hazardous Materials Information System

NFPA = National Fire Protection Association

EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



Lean MDEA - 101

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0968
Revision Date 10/03/2001

IMPORTANT. Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product

Emergency Overview

Physical State	Liquid		
Color	Yellow to brown or black	Odor	Faint to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal
	Heating of MDEA solutions above 140°F will darken the liquid mixture		

WARNING!

Contains low levels of Hydrogen Sulfide (H₂S) and Ammonia (NH₃)! Extremely flammable and toxic vapor may be released if this mixture is subjected to high heat, steam, or hot surfaces, contact with acids, or severe agitation.

Vapor may cause flash fire or explosion.

May react violently with acids, acidic solutions, or halogenated materials.

Reactions may generate extremely flammable H₂ and H₂S gas release.

May be harmful or fatal if inhaled or ingested.

High concentrations of vapor reduce oxygen available for breathing and may cause nervous system depression or paralysis and suffocation.

If swallowed, may cause severe irritation to the mouth, throat, esophagus, and stomach. Overexposures may cause target organ effects such as liver, kidney, and/or blood damage.

Eye damage or skin and/or respiratory tract irritation may result from vapor or liquid contact.

Might be corrosive to some metallic substances.

Spills may create a slipping hazard.

RS0968
HFR 210
HDS-0 732
HDS-C 733/735
736 SRU
737 Hazcom-9
ADU JACK

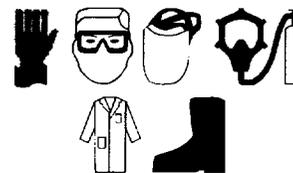
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 3	2
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Lean MDEA	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	0096800968	Medical Emergency	(918) 495-4700
CAS Number	Mixture---See Section 2.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Alkaline process water		
Synonyms	Lean Amine, Lean Methyl Diethanolamine Solution, Steam-stripped MDEA Solution, Aqueous Solution Containing 2,2'-(Methylimino)-Bisethanol Plus Low Levels of Hydrogen Sulfide and Ammonia, Alkanolamine Extraction Solution, Extractant Solution Containing Low Levels of H ₂ S and NH ₃ , Sour Contactor Influent, Effluent from the Amine Steam Stripper and Tail Gas Stripper Towers		

Lean MDEA - 101

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Water	7732-18-5	60-80
2) Methyl diethanolamine (MDEA) / UCAFSOL-101	105-59-9	20-40
3) Hydrogen sulfide	7783-06-4	0-0.05
4) Ammonia	7664-41-7	0-0.005

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye contact Inhalation Skin Absorption Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	<p>Inhalation is not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of mist or liquid droplets may cause respiratory tract and mucous membrane irritation, and possibly, pulmonary edema and chemical pneumonia.</p> <p>Generated vapor may be harmful or fatal if inhaled! Inhalation of the released vapor may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Ammonia (NH₃) vapors may cause severe lung effects which might be delayed in onset. Symptoms are characterized by coughing, choking, or shortness of breath. NIOSH has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S cause unconsciousness and respiratory paralysis leading to coma and/or death. Also, NIOSH has determined that atmospheres containing 300 ppm or more of NH₃ are immediately dangerous to life and health. (See Section 11.)</p>
Eye Contact	<p>Direct liquid contact may cause eye irritation upon short-term exposure and can produce severe, and possibly permanent, tissue damage if not promptly removed. The severity of the effects depend on the concentration of the diethanolamine and ammonia components and how soon after exposure the eyes are washed.</p> <p>Generated vapor may cause severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and ammonia and duration of exposure.</p>
Skin Contact	<p>May be mildly to moderately irritating to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solution (0.04 wt % ammonia) to minutes with more concentrated solutions. Prolonged or repeated contact, even to dilute concentrations of ammonia solutions, may cause some degree of permanent tissue destruction. Methyl diethanolamine and hydrogen sulfide can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.</p>
Ingestion	<p>Ingestion is unlikely. However, if swallowed, this material may cause gastrointestinal tract irritation, nausea, and vomiting, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon the methyl diethanolamine and ammonia concentrations, ulceration of the gastrointestinal tract may also occur.</p>
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures.</p> <p>Chronic dyspnea, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several workers two years after their occupational overexposures to mists or aerosols of ammonia. Also, when ingested by rats, aqueous ammonia solutions have been shown to cause gastrointestinal tract tumors.</p> <p>If ingested or absorbed through intact skin, methyl diethanolamine can cause mucous membrane, kidney, liver, and/or blood damage based upon rodent studies. (See Section 11.)</p>

Lean MDEA - 161

Conditions Aggravated by Exposure	Personnel with pre-existing eye, skin, or gastrointestinal disorders, nervous system diseases, impaired liver or kidney function, or chronic respiratory diseases neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material's components. They should take additional precautions to minimize or avoid exposure
Target Organs	This material is potentially toxic to eyes, skin, mucous membranes, lungs, nervous systems, brain, liver, kidneys, and possibly the blood
Carcinogenic Potential	This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200)

OSHA Health Hazard Classification		OSHA Physical Hazard Classification							
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with water under a cool or cold shower for at least 15 minutes while removing contaminated shoes and clothing. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, creases, and groin area. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.

Notes to Physician
If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated tissue with a **dilute solution of boric acid or acetic acid**. Prolonged irrigation may be required in severe cases, occasionally from 12 up to 24 hours. pH testing of the skin at least 15 minutes after stopping irrigation allows alkali time to diffuse to the skin surface and helps guide the need for further irrigation. Continue irrigation until skin pH is neutral.

Exposure to **methyl diethanolamine** vapor may cause minor transient edema of the corneal epithelium. This condition, referred to as "glaucompsia, blue haze, or blue-gray haze", produces a blurring of vision against a general bluish background and the appearance of halos around bright objects. This effect disappears spontaneously within a few hours of the end of exposure and leaves no after-effects. Although not detrimental to the eye per se, glaucompsia predisposes an affected individual to physical accidents and reduces the ability to undertake skilled tasks, such as driving a motorized vehicle.

Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

Nitrite as an antidote for acute **hydrogen sulfide** intoxication may only be effective within the first few

Lean MDEA - 101

minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	This mixture is non-flammable under normal conditions of use, however, if improperly handled, generated H ₂ S or H ₂ vapors are Extremely Flammable and Explosive!		
Flash Point Method	Not applicable or AP -73°C (-100°F) for H₂S and AP 126°C (259°F) for undiluted methyl diethanolamine [ASTM D-56]		
Lower Flammable Limit	Not applicable or AP 4.0% for H ₂ S.	Upper Flammable Limit	Not applicable or 45% for H ₂ S
Autoignition Temperature	Not applicable or AP 260°C (500°F) for H₂S and AP 650°C (1200°F) for undiluted methyl diethanolamine .		
Hazardous Combustion Products	Contact with some metals can generate extremely flammable hydrogen (H₂) gas. This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!		
Special Properties	High heat, hot surface contact, or mixing with acids may spring steam, extremely flammable H ₂ S, and/or toxic NH ₃ vapors out of this solution. H ₂ S is heavier than air and may travel long distances along the ground to an ignition source and flash back. It may also create a vapor/air explosion hazard in confined spaces such as in sewers. Adding this mixture directly to unbuffered water may cause a slightly exothermic reaction.		
Extinguishing Media	Non-combustible, if handled and stored properly. Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.		
Protection of Fire Fighters	This material is not expected to burn. However, in the event that gases are being generated or surrounding materials are involved in a fire, firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Avoid contact with damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. For large spills, dike far ahead of spill to maximize later product recovery or disposal. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and proper protective clothing during cleanup operations. This material may react strongly with acids. Never flush to the sewer. In urban areas, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists to minimize physical habitat damage. If appropriate, neutralize with a dilute solution of **boric acid or acetic acid**. A vacuum truck may be used to collect the bulk. Spills on other than pavement may be handled by removing the affected soil and placing it into approved containers for later disposal. Comply with all laws and regulations.

Lean MDEA - 101

SECTION 7: HANDLING AND STORAGE**Handling**

Do not breathe mist or vapor. Do not get in eyes, on skin, or on clothing. Wear suitable personal protective equipment to prevent eye and skin contact. Wash thoroughly after handling.

Danger! Corrosive or Irritating Liquid and/or Poisonous and Flammable Gas! Do NOT breathe mist or vapor, it may contain **hydrogen sulfide (H₂S)**, and/or **ammonia (NH₃)**. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with adequate ventilation and personal protective equipment. Do not allow material to contact eyes, skin or other tissues, and clothing. Wear corrosion-resistant protective work clothing and chemical splash goggles and face shield when contact is anticipated. Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for H₂S concentrations and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Drain and purge equipment as necessary to remove material residues. However, empty containers may still contain flammable, corrosive, and/or poisonous residue.

Storage

Store in containers appropriate for **dilute diethanolamine and ammonia solutions** and away from acids. Diluted material may accelerate corrosion of metal containers.

Store and transport in accordance with all applicable laws. Do not store this material in unlabeled containers. Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. If possible, store containers in a separate safety cabinet or room. The H₂S component of this material is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION**Engineering Controls**

No special ventilation is required under normal conditions of use. Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Where **hydrogen sulfide and/or ammonia** may be generated, special ventilation will be required. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

**Eye Protection**

Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Thermal protection should be provided if the solution has a temperature above 120 degrees F. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact. Use of chemical-resistant gloves (e.g., PVC, neoprene, or nitrile) is required. Thermal protection should be used whenever the solution has a temperature above 120 degrees F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.

Lean MDEA - 101

Body Protection	Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (e.g., vinyl, Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. Thermal protection should be provided when the solution has a temperature above 120 degrees F. If general contact occurs, IMMEDIATELY remove soaked clothing and shower thoroughly. Contaminated leather goods should be removed immediately and discarded.
Respiratory Protection	Misting or vapor generation is not expected under normal conditions of use, so respiratory protection is not anticipated under normal use conditions and with adequate ventilation. However, when anticipated or if generated hydrogen sulfide or ammonia are present at concentrations above applicable workplace exposure levels, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g., ANSI Z88.2).
General Comments	Releases of loosely bound hydrogen sulfide and/or ammonia may create flammable, explosive, toxic, and/or oxygen-deficient atmospheres (LT 19.5 Vol % in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency and hydrogen sulfide. Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA 10 STEL 15 (ppm) from ACGIH (TLV) TWA 5 (ppm) from ACGIH (TLV) [Proposed]
2) Ammonia	TWA 10 STEL 15 CEIL 20 (ppm) from OSHA (PEL) TWA 25 STEL 35 (ppm) from ACGIH (TLV) STEL 35 (ppm) from OSHA (PEL) TWA 50 STEL 35 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Yellow to brown or black. Heating of MDEA solutions above 140°F will darken the liquid mixture.	Odor	Faint to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal.
Specific Gravity	1.02 to 1.05 (Water = 1)	pH	11.0 to 11.5 [Moderately Basic]	Vapor Density	0.59 to 3.21 (Air = 1)
Boiling Point/Range	-79° to 148°C (-110° to 299°F) at 14.7 psia	Melting/Freezing Point			-129° to 0°C (-200° to 32°F) at 14.7 psia
Vapor Pressure	LT 0.1 mm of Hg at 68°F (20°C) for the aqueous solution; 212 to 394 psia at 100°F (38°C) based upon released H ₂ S and NH ₃ .	Viscosity (cSt @ 40°C)			1-2
Solubility in Water	Completely soluble in cold water, but may cause an exothermic reaction.	Volatile Characteristics			Negligible volatility in proper storage.
Additional Properties	A 1% solution of ammonia has a greater than 9.0 pH and methyl diethanolamine has an 11.0 to 11.5 pH. Ammonia has a vapor density lighter than air and will disperse rapidly, however, hydrogen sulfide has a vapor density heavier than air and will tend to accumulate in low places or travel along the ground creating a flashback fire hazard.				

Lean MDEA - 101

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur
Conditions to Avoid	Keep away from strong acids, heat and hot surfaces, steam, strong oxidizing conditions, and severe agitation Avoid direct contact with organic halogen compounds		
Materials Incompatibility	Strong acids and other oxidizing agents, halogenated compounds, and some heavy metals Ammonia solutions are corrosive to chromium and silver and alloys containing these metals and will react violently with their powdered forms Methyl diethanolamine solutions are corrosive to copper, aluminum, and zinc and alloys containing these metals including galvanized iron and will react with nitrite compounds to form carcinogenic nitrosamine compounds		
Hazardous Decomposition Products	Contact with some metals can generate extremely flammable hydrogen (H ₂) gas Free aromatic amines may be released in a reducing environment		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data**Hydrogen sulfide:**

GAS (TCLo). Acute	10 ppm for 15 minutes [Human] - Eye irritation
GAS (TCLo) Acute	50 to 100 ppm for 15 minutes [Human] - Respiratory irritation
GAS (LC ₁₀₀) Acute	600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death.
GAS (LCLo) Acute	5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death

Ammonia:

ORAL (LDLo) Acute	132 mg/kg [Human]
ORAL (TDLo) Acute	15 uL/kg [Human] - Structural changes in the esophagus
GAS (TCLo) Acute	20 ppm for 1hour [Human] - Eye irritation, ulcerated nasal septum, and structural changes in the trachea or bronchi
GAS (LCLo) Acute	5,000 ppm for 5 minutes [Human]
GAS (LCLo) Acute	5,000 ppm for 5 minutes [Guinea Pig]
GAS (LC ₅₀) Acute	2,000 ppm for 4 hours [Rat]
GAS (LC ₅₀) Acute	7,000 mg/m ³ for 1 hour [Cat and Rabbit] - Excitement and flaccid paralysis without anesthesia
GAS (LC ₅₀) Acute	4,230 ppm for 1 hour [Mouse] - Ataxia, tremors, and convulsions

Methyl diethanolamine (MDEA or 2,2'-Methyliminodiethanol):

ORAL (LD ₅₀) Acute	1,945 mg/kg [Rat] - Hypermotility, diarrhea, ataxia, and chromodacryorrhea
ORAL (LD ₅₀) Acute	5,990 uL/kg [Rabbit]
INTRAPERITONEAL (LD ₅₀). Acute	500 mg/kg [Mouse].

Aqueous methyl diethanolamine (MDEA) solutions are alkaline and may be absorbed through the intact skin At low concentrations, it is a mild to moderate irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts MDEA was shown not to be genotoxic in various mutagenicity and clastogenicity assays **If reacted with nitrites, MDEA can form nitrosamine compounds**, which are "suspected human carcinogens".

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs At higher concentrations (GT 50 ppm), H₂S odor is not apparent NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis At concentrations between 600 and 750 ppm, death occurs within 15 minutes The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects

Ammonia is a strong base and forms **ammonium hydroxide** upon contact with water This material is corrosive to many organic compounds If ingested, ammonia can cause severe pain, bloody diarrhea,

Lean MDEA - 101

cardiovascular collapse, and death. Concentrated ammonia is a strong corrosive which can cause burns of the following types: cryogenic from contact with refrigerated liquid, thermal from exothermic reaction with water, and chemical from its alkalinity. It gelatinizes the tissue, forming deep and painful lesions. At low concentrations, aqueous ammonia is a moderate to strong irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. Its effects on the lungs can be severe and delayed in onset, respiratory support may be required following acute inhalation. However, there seems to be a wide variability in the human sensitivity to ammonia.

Chronic dyspnea, restrictive lung dysfunction, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several employees two years after their occupational overexposures to mists and aerosols of ammonia. An **aqueous ammonia solution** caused gastrointestinal cicatricial tumors in rats following a 24-week feeding assay. NH_3 produced a positive mutagenic response in the Ames Assay and caused chromosomal aberrations during a 16-week cytogenic study using rats. However, in general, pH alterations produce false positive results in short-term genetic assays.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Vapor releases from this material are expected to cause significant immediate impact but only localized non-persistent environmental damage. Due caution should be exercised to prevent an accidental release into the environment. This material and any contaminated soil or other water may be hazardous to human, animal, and aquatic life. Volatile components may contribute to smog formation.
Environmental Fate	This material is soluble in water and is expected to readily disperse in marine environments. Caustic solutions have produced slight to moderate toxicity in laboratory tests with aquatic organisms. It is expected to be moderately alkaline. If released to surface water, it may cause a pH rise depending upon the buffering capacity of the waterbody. Aquatic organisms become increasingly stressed as pH concentration exceeds 9.0, with many species being intolerant of pH of 10.0 or higher. Substances in this mixture do not bioaccumulate. For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

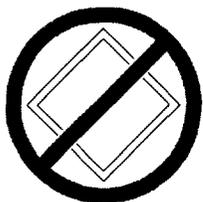
Conditions of use may cause this material to become a "corrosive" hazardous waste (D002), as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Maximize component recovery prior for reuse or recycling. Potential treatment and disposal methods include steam stripping, bio-oxidation, incineration, and land disposal, if permitted. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is not regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Not regulated		
Hazard Class	Not a DOT controlled material	Packing Group(s)	Not applicable
		UN/NA ID	Not applicable
Reportable Quantity	A Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are Hydroxide sulfide and Ammonia .		

Lean MDEA - 101

Placards



Emergency Response Guide No.	Not applicable.
HAZMAT STCC No.	Not applicable
MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material might contain detectable concentrations of the following chemical substances subject to this statute: Hydrogen sulfide [CAS No. 7783-06-4] and Ammonia [CAS No. 7664-41-7]
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) and Chronic (Delayed) Health, and Reactivity Hazards
SARA 313	This material does not contain any components in concentrations which are at or above de minimis levels and are listed as "toxic chemicals" in 40 CFR Part 372 pursuant to the requirements of Section 313.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances which might be present in this material subject to this statute are: Hydroxide sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.4 kg]) concentration: 0 to 0.05% Ammonia [CAS No. 7664-41-7] (RQ = 100 lbs. [45.4 kg]) concentration: 0 to 0.005%.
CWA	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2.
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. A chemical substance which might be present in this material that is subject to this statute is: Hydroxide sulfide [CAS No. 7783-06-4]

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SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3 1
Revision Date 10/03/2001
Print Date Printed on 10/03/2001.

ABBREVIATIONS

AP = Approximately Established EQ = Equal > = Greater Than < = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association
 IARC = International Agency for Research on Cancer NTP = National Toxicology Program
 NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration
 NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System
 NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

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***** END OF MSDS *****



Rich MDEA - 101

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0969
Revision Date 10/03/2001

IMPORTANT Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product

Emergency Overview

Physical State	Liquid		
Color	Yellow to brown or black	Odor	Faint to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal
	Heating of MDEA solutions above 140°F will darken the liquid mixture		

DANGER!

Contains Hydrogen Sulfide (H₂S) and Ammonia (NH₃)!
Extremely flammable and toxic vapor may be released if this mixture is subjected to high heat, steam, or hot surfaces, contact with acids, or severe agitation.

Vapor may cause flash fire or explosion.

May react violently with acids, acidic solutions, or halogenated materials.

Reactions may generate extremely flammable H₂ and H₂S gas release.

May be harmful or fatal if inhaled or ingested.

High concentrations of vapor reduce oxygen available for breathing and may cause nervous system depression or paralysis and suffocation.

If swallowed, may cause severe irritation or chemical burns to the mouth, throat, esophagus, and stomach. Overexposures may cause target organ effects such as liver, kidney, and/or blood damage.

Eye damage or skin and/or respiratory tract irritation may result from vapor or liquid contact.

May be corrosive to some metallic substances.

Spills may create a slipping hazard.

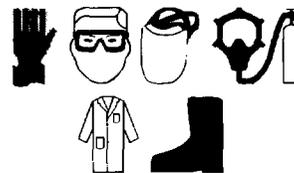
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 4	3
Fire Hazard	1	1
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



clarence
Barbara
Melinda
M.I.
maint-2
medical

RS0969
HFR 311

HDS-O 732
HDS-C 733/735
736
737
ADU
SAU
HAZcom-9
JACK

SECTION 1: IDENTIFICATION

Trade Name	Rich MDEA	Technical Contact	(800) 525-4692 or (713) 321-4269 (M-F)
Product Number	0096900969	Medical Emergency	(918) 495-4700
CAS Number	Mixture---See Section 2	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Alkaline process water		
Synonyms	Rich Amine, Rich Methyl Diethanolamine Solution, Saturated MDEA Solution, Aqueous Solution Containing 2,2'-(Methylimino)-Bisethanol, Hydrogen Sulfide, and Ammonia, Saturated Alkanolamine Extraction Solution, Extractant Solution Containing H ₂ S and NH ₃ , Sour Contactor Effluent, Feed to the Amine Steam Stripper and Tail Gas Stripper Towers		

Rich MDEA - 101

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Water	7732-18-5	49-79
2) Methyl diethanolamine (MDEA) / UCARSOL - 101	105-59-9	20-50
3) Hydrogen sulfide	7783-06-4	0.5-15
4) Ammonia	7664-41-7	0.5-5

SECTION 3: HAZARDS IDENTIFICATION

Also see *Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.*

Major Route(s) of Entry Skin Contact Eye contact Inhalation Skin Absorption Ingestion

Signs and Symptoms of Acute Exposure

Inhalation	<p>Inhalation is not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of mist or liquid droplets may cause respiratory tract irritation, mucous membrane tissue burns, and possibly, pulmonary edema and chemical pneumonia</p> <p>Generated vapor may be harmful or fatal if inhaled! Inhalation of the released vapor may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure Ammonia (NH₃) vapors may cause severe lung effects which might be delayed in onset. Symptoms are characterized by coughing, choking, or shortness of breath. NIOSH has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S cause unconsciousness and respiratory paralysis leading to coma and/or death. Also, NIOSH has determined that atmospheres containing 300 ppm or more of NH₃ are immediately dangerous to life and health. (See Section 11)</p>
Eye Contact	<p>Direct liquid contact may cause eye irritation upon short-term exposure and can produce severe, and possibly permanent, tissue damage if not promptly removed. The severity of the effects depend on the concentration of the diethanolamine and ammonia components and how soon after exposure the eyes are washed</p> <p>Generated vapor may cause severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide and ammonia and duration of exposure</p>
Skin Contact	<p>May be moderately irritating or corrosive to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solution (0.04 wt % ammonia) to minutes with more concentrated solutions. Prolonged or repeated contact, even to dilute concentrations of ammonia solutions, may cause some degree of permanent tissue destruction. Methyl diethanolamine and hydrogen sulfide can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases</p>
Ingestion	<p>Ingestion is unlikely. However, if swallowed, this material may cause gastrointestinal tract irritation, nausea, and vomiting, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon the methyl diethanolamine and ammonia concentrations, ulceration of the gastrointestinal tract may also occur</p>
Chronic Health Effects Summary	<p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures</p> <p>Chronic dyspnea, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several workers two years after their occupational overexposures to mists or aerosols of ammonia. Also, when ingested by rats, aqueous ammonia solutions have been shown to cause gastrointestinal tract tumors</p> <p>If ingested or absorbed through intact skin, methyl diethanolamine can cause mucous membrane, kidney, liver, and/or blood damage based upon rodent studies. (See Section 11)</p>

Rich MDEA - (01)

Conditions Aggravated by Exposure Personnel with pre-existing eye, skin, or gastrointestinal disorders, nervous system diseases, impaired liver or kidney function, or chronic respiratory diseases neurological disorders, high blood pressure, and those with a compromised ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of this material's components. They should take additional precautions to minimize or avoid exposure.

Target Organs This material is potentially toxic to eyes, skin, mucous membranes, lungs, nervous systems, brain, liver, kidneys, and possibly the blood, heart, and/or the reproductive systems.

Carcinogenic Potential This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
- Skin Contact** Flush thoroughly with water under a cool or cold shower for at least 15 minutes while removing contaminated shoes and clothing. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases, and groin area. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse.
- Ingestion** Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.
- Notes to Physician** If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a dilute solution of boric acid or acetic acid. Prolonged irrigation may be required in severe cases, occasionally from 12 up to 24 hours. pH testing of the skin at least 15 minutes after stopping irrigation allows alkali time to diffuse to the skin surface and helps guide the need for further irrigation. Continue irrigation until skin pH is neutral.
- Exposure to **methyl diethanolamine** vapor may cause minor transient edema of the corneal epithelium. This condition, referred to as "glaucompsia, blue haze, or blue-gray haze", produces a blurring of vision against a general bluish background and the appearance of halos around bright objects. This effect disappears spontaneously within a few hours of the end of exposure and leaves no after-effects. Although not detrimental to the eye per se, glaucompsia predisposes an affected individual to physical accidents and reduces the ability to undertake skilled tasks, such as driving a motorized vehicle.
- Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.
- Nitrite as an antidote for acute **hydrogen sulfide** intoxication may only be effective within the first few

Rich MDEA - 101

minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	This mixture is non-flammable under normal conditions of use, however, if improperly handled, generated H ₂ S or H ₂ vapors are Extremely Flammable and Explosive!
Flash Point Method	Not applicable or AP -73°C (-100°F) for H ₂ S and AP 126°C (259°F) for undiluted methyl diethanolamine [ASTM D-56]
Lower Flammable Limit	Not applicable or AP 4.0% for H ₂ S.
Upper Flammable Limit	Not applicable or 45% for H ₂ S
Autoignition Temperature	Not applicable or AP 260°C (500°F) for H ₂ S and AP 650°C (1200°F) for undiluted methyl diethanolamine .
Hazardous Combustion Products	Contact with some metals can generate extremely flammable hydrogen (H₂) gas. This gas is extremely flammable at well below ambient temperatures and immediately forms explosive mixtures with air. If released, immediately evacuate personnel to a safe upwind area. It is lighter than air and rises rapidly collecting in the upper portions of confined spaces. Exposed to an ignition source, it can ignite with explosive force. Keep away from all ignition sources!
Special Properties	High heat, hot surface contact, or mixing with acids may spring steam, extremely flammable H ₂ S, and/or toxic NH ₃ vapors out of this solution. H ₂ S is heavier than air and may travel long distances along the ground to an ignition source and flash back. It may also create a vapor/air explosion hazard in confined spaces such as in sewers. Adding this mixture directly to unbuffered water may cause a slightly exothermic reaction.
Extinguishing Media	Non-combustible, if handled and stored properly. Use extinguishing media suitable for the surrounding fire. In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out. If possible, isolate materials not yet involved in the fire and protect personnel. Move containers away from fire area if it can be done without risk.
Protection of Fire Fighters	This material is not expected to burn. However, in the event that gases are being generated or surrounding materials are involved in a fire, firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Avoid contact with damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. For large spills, dike far ahead of spill to maximize later product recovery or disposal. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and proper protective clothing during cleanup operations. This material may react strongly with acids. Never flush to the sewer. In urban areas, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists to minimize physical habitat damage. If appropriate, neutralize with a dilute solution of **boric acid or acetic acid**. A vacuum truck may be used to collect the bulk. Spills on other than pavement may be handled by removing the affected soil and placing it into approved containers for later disposal. Comply with all laws and regulations.

Rich MDEA - 101

SECTION 7: HANDLING AND STORAGE**Handling**

Do not breathe mist or vapor Do not get in eyes, on skin, or on clothing Wear suitable personal protective equipment to prevent eye and skin contact Wash thoroughly after handling

Danger! Corrosive or Irritating Liquid and/or Poisonous and Flammable Gas! Do NOT breathe mist or vapor, it may contain **hydrogen sulfide (H₂S), and/or ammonia (NH₃)** Odor is not an adequate warning of potentially hazardous air concentrations Use only with adequate ventilation and personal protective equipment Do not allow material to contact eyes, skin or other tissues, and clothing Wear corrosion-resistant protective work clothing and chemical splash goggles and face shield when contact is anticipated Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for H₂S concentrations and flammability

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area Eliminate heat and other ignition sources Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 Drain and purge equipment as necessary to remove material residues However, empty containers may still contain flammable, corrosive, and/or poisonous residue

Storage

Store in containers appropriate for **dilute diethanolamine and ammonia solutions** and away from acids Diluted material may accelerate corrosion of metal containers

Store and transport in accordance with all applicable laws Do not store this material in unlabeled containers Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles If possible, store containers in a separate safety cabinet or room The H₂S component of this material is corrosive to most metals It can cause steel pipe to become blistered, pitted, and brittle Metal components used for storage should be resistant to sulfide stress cracking (See appropriate API and NACE standards)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION**Engineering Controls**

No special ventilation is required under normal conditions of use Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated Where **hydrogen sulfide and/or ammonia** may be generated, special ventilation will be required Ensure that an emergency eye wash station and safety shower are near the work-station location

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations The following pictograms represent the minimum requirements for personal protective equipment For certain operations, additional PPE may be required

**Eye Protection**

Safety glasses with side shields are recommended as a minimum protection When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn Thermal protection should be provided if the solution has a temperature above 120 degrees F Suitable eye wash water should be readily available

Hand Protection

Avoid skin contact Use of chemical-resistant gloves (e.g., PVC, neoprene, or nitrile) is required Thermal protection should be used whenever the solution has a temperature above 120 degrees F Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities

Rich MDEA - 101

- Body Protection** Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (e.g., vinyl, Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. Thermal protection should be provided when the solution has a temperature above 120 degrees F. If general contact occurs, IMMEDIATELY remove soaked clothing and shower thoroughly. Contaminated leather goods should be removed immediately and discarded.
- Respiratory Protection** Mist or vapor generation is not expected under normal conditions and with adequate ventilation. However, when anticipated or if generated **hydrogen sulfide or ammonia** are present at concentrations above applicable workplace exposure levels, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g., ANSI Z88.2).
- General Comments** Releases of loosely bound **hydrogen sulfide and/or ammonia** may create flammable, explosive, toxic, and/or oxygen-deficient atmospheres (LT 19.5 Vol % in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air-purifying respirators offer no protection against oxygen deficiency and hydrogen sulfide.
- Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Hydrogen sulfide	TWA 10 STEL 15 (ppm) from ACGIH (TLV) TWA 5 (ppm) from ACGIH (TLV) [Proposed]
2) Ammonia	TWA 10 STEL 15 CEIL 20 (ppm) from OSHA (PEL) TWA 25 STEL 35 (ppm) from ACGIH (TLV) STEL 35 (ppm) from OSHA (PEL) [1989] TWA 50 STEL 35 (ppm) from OSHA (PEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Yellow to brown or black. Heating of MDEA solutions above 140°F will darken the liquid mixture.	Odor	Faint to strong, unpleasant, and possibly distinctive of rotten eggs or ammoniacal.
Specific Gravity	1.02 to 1.05 (Water = 1)	pH	11.0 to 11.5 [Moderately Basic]	Vapor Density	0.59 to 3.21 (Air = 1)
Boiling Point/Range	-79° to 148°C (-110° to 299°F) at 14.7 psia			Melting/Freezing Point	-129° to 0°C (-200° to 32°F) at 14.7 psia
Vapor Pressure	LT 0.1 mm of Hg at 68°F (20°C) for the aqueous solution, 212 to 394 psia at 100°F (38°C) based upon released H ₂ S and NH ₃ .			Viscosity (cSt @ 40°C)	1-2
Solubility in Water	Completely soluble in cold water; but may cause an exothermic reaction.			Volatile Characteristics	Negligible volatility in proper storage.
Additional Properties	A 1% solution of ammonia has a greater than 9.0 pH and methyl diethanolamine has an 11.0 to 11.5 pH. Ammonia has a vapor density lighter than air and will disperse rapidly, however, hydrogen sulfide has a vapor density heavier than air and will tend to accumulate in low places or travel along the ground creating a flashback fire hazard.				

Rich MDEA - 101

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization Not expected to occur
Conditions to Avoid	Keep away from strong acids, heat and hot surfaces, steam, strong oxidizing conditions, and severe agitation. Avoid direct contact with organic halogen compounds.	
Materials Incompatibility	Strong acids and other oxidizing agents, halogenated compounds, and some heavy metals. Ammonia solutions are corrosive to chromium and silver and alloys containing these metals and will react violently with their powdered forms. Methyl diethanolamine solutions are corrosive to copper, aluminum, and zinc and alloys containing these metals including galvanized iron and will react with nitrite compounds to form carcinogenic nitrosamine compounds.	
Hazardous Decomposition Products	Contact with some metals can generate extremely flammable hydrogen (H ₂) gas. Free aromatic amines may be released in a reducing environment.	

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data	Hydrogen sulfide:	
	GAS (TCLo) Acute	10 ppm for 15 minutes [Human] - Eye irritation
	GAS (TCLo) Acute	50 to 100 ppm for 15 minutes [Human] - Respiratory irritation
	GAS (LC ₁₀₀) Acute	600 to 750 ppm for 30 minutes [Human] - Respiratory paralysis and death
	GAS (LCLo) Acute	5,700 ug/kg for 8 hours [Human] - Chronic pulmonary edema, coma, and death
	Ammonia:	
	ORAL (LDLo) Acute	132 mg/kg [Human]
	ORAL (TDLo) Acute	15 uL/kg [Human] - Structural changes in the esophagus
	GAS (TCLo) Acute	20 ppm for 1 hour [Human] - Eye irritation, ulcerated nasal septum, and structural changes in the trachea or bronchi
	GAS (LCLo) Acute	5,000 ppm for 5 minutes [Human]
	GAS (LCLo) Acute	5,000 ppm for 5 minutes [Guinea Pig]
	GAS (LC ₅₀) Acute	2,000 ppm for 4 hours [Rat]
	GAS (LC ₅₀) Acute	7,000 mg/m ³ for 1 hour [Cat and Rabbit] - Excitement and flaccid paralysis without anesthesia
	GAS (LC ₅₀) Acute	4,230 ppm for 1 hour [Mouse] - Ataxia, tremors, and convulsions
	Methyl diethanolamine (MDEA or 2,2'-Methyliminodiethanol):	
	ORAL (LD ₅₀) Acute	1.945 mg/kg [Rat] - Hypermotility, diarrhea, ataxia, and chromodacryorrhea
	ORAL (LD ₅₀) Acute	5,990 uL/kg [Rabbit]
	INTRAPERITONEAL (LD ₅₀) Acute	500 mg/kg [Mouse]

Aqueous methyl diethanolamine (MDEA) solutions are alkaline and may be absorbed through the intact skin. At low concentrations, it is a mild to moderate irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. MDEA was shown not to be genotoxic in various mutagenicity and clastogenicity assays. **If reacted with nitrites, MDEA can form nitrosamine compounds**, which are "suspected human carcinogens".

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Ammonia is a strong base and forms **ammonium hydroxide** upon contact with water. This material is corrosive to many organic compounds. If ingested, ammonia can cause severe pain, bloody diarrhea,

Rich MDEA - 101

cardiovascular collapse, and death. Concentrated ammonia is a strong corrosive which can cause burns of the following types: cryogenic from contact with refrigerated liquid, thermal from exothermic reaction with water, and chemical from its alkalinity. It gelatinizes the tissue, forming deep and painful lesions. At low concentrations, aqueous ammonia is a moderate to strong irritant to the eyes, skin, mucous membranes, and respiratory and digestive tracts. Its effects on the lungs can be severe and delayed in onset, respiratory support may be required following acute inhalation. However, there seems to be a wide variability in the human sensitivity to ammonia.

Chronic dyspnea, restrictive lung dysfunction, obstructive lung disease, and bronchial hyper-reactivity were adverse effects experienced by several employees two years after their occupational overexposures to mists and aerosols of ammonia. An aqueous ammonia solution caused gastrointestinal cicatricial tumors in rats following a 24-week feeding assay. NH₃ produced a positive mutagenic response in the Ames Assay and caused chromosomal aberrations during a 16-week cytogenetic study using rats. However, in general, pH alterations produce false positive results in short-term genetic assays.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Vapor releases from this material are expected to cause significant immediate impact but only localized non-persistent environmental damage. Due caution should be exercised to prevent an accidental release into the environment. This material and any contaminated soil or other water may be hazardous to human, animal, and aquatic life. Volatile components may contribute to smog formation.
Environmental Fate	This material is soluble in water and is expected to readily disperse in marine environments. Caustic solutions have produced slight to moderate toxicity in laboratory tests with aquatic organisms. It is expected to be moderately alkaline. If released to surface water, it may cause a pH rise depending upon the buffering capacity of the waterbody. Aquatic organisms become increasingly stressed as pH concentration exceeds 9.0, with many species being intolerant of pH of 10.0 or higher. Substances in this mixture do not bioaccumulate. For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Conditions of use may cause this material to become a "corrosive" hazardous waste (D002), as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Maximize component recovery prior for reuse or recycling. Potential treatment and disposal methods include steam stripping, bio-oxidation, incineration, and land disposal, if permitted. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Corrosive liquid, toxic, n.o.s. Inhalation Hazard Zone B (Hydrogen sulfide, Ammonia)		
Hazard Class	DOT Class 8 (Corrosive liquid)	Packing Group(s)	PG II
		UN/NA ID	UN2922
Reportable Quantity	A Reportable Quantity (RQ) substance components in this material which require DOT HAZMAT bill-of-lading display are Hydroxide sulfide and Ammonia .		

Rich MDEA -101

Placards



Emergency Response Guide No.	154
HAZMAT STCC No.	49 360 15
MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material contains detectable concentrations of the following chemical substances subject to this statute: Hydrogen sulfide [CAS No. 7783-06-4] and Ammonia [CAS No. 7664-41-7]
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) and Chronic (Delayed) Health, and Reactivity Hazards.
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313: Hydroxide sulfide [CAS No. 7783-06-4] concentration: 0.5 to 10% Ammonia [CAS No. 7664-41-7] concentration: 0.5 to 5%.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are: Hydroxide sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.4 kg]) concentration: 0.5 to 10% Ammonia [CAS No. 7664-41-7] (RQ = 100 lbs. [45.4 kg]) concentration: 0.5 to 5%.
CWA	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. A chemical substance present in this material which is subject to this statute is: Hydroxide sulfide [CAS No. 7783-06-4]

Rich MDEA -101

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 3 1
Revision Date 10/03/2001
Print Date Printed on 10/03/2001

ABBREVIATIONS

AP = Approximately Established EQ = Equal > = Greater Than < = Less Than NA = Not Applicable ND = No Data NE = Not

ACGIH = American Conference of Governmental Industrial Hygienists AIHA = American Industrial Hygiene Association
 IARC = International Agency for Research on Cancer NTP = National Toxicology Program
 NIOSH = National Institute of Occupational Safety and Health OSHA = Occupational Safety and Health Administration
 NPCA = National Paint and Coating Manufacturers Association HMIS = Hazardous Materials Information System
 NFPA = National Fire Protection Association EPA = Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



Merox Rich Caustic

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0975
Revision Date 09/01/2000

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid
Color Light to dark blue
Odor Odorless to strong, unpleasant, and possibly distinctive of rotten eggs or skunk.

DANGER! or WARNING! Highly to Moderately Corrosive!
May cause severe burns, perforation, and irreversible tissue damage!
Eye and/or skin irritation or dermal sensitization may result from prolonged or repeated contact with dilute caustic solutions!
Health effects may be delayed! Avoid contact. Wash skin thoroughly but gently with soap and water after contact. Launder or neutralize contaminated clothing and protective equipment before wearing.
May be harmful or fatal if inhaled or swallowed!
May cause severe respiratory and/or gastrointestinal tract ulceration! Aspiration into the lungs can cause pulmonary edema and chemical pneumonia! If swallowed, seek medical attention immediately.
May be corrosive to some organic and metallic substances!
May react violently with acids, acidic solutions, or halogenated materials!
Reactions may generate extremely flammable hydrogen and/or H₂S gas!
Contains bound Hydrogen Sulfide (H₂S) and Mercaptans! Flammable and toxic gas may be released if this mixture is subjected to high heat or hot surfaces, contact with acids, or severe agitation!
Do not store in open, unmarked, or incompatible containers.
Spills may create a slipping hazard!

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 3	3
Fire Hazard	1	1
Reactivity	1	1

COR

* = Chronic Health Hazard

Protective Equipment

Minimum Requirements
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Merox Rich Caustic	Technical Contact	(800) 525-4692 or (630) 257-4288 (M-F)
Product Number	0097500975	Medical Emergency	(918) 495-4700
CAS Number	Mixture—See Section 2	CHEMTREC Emergency	(800) 424-9300
Product Family	Alkaline or highly basic aqueous process solution		
Synonyms	Rich Caustic, Circulation Caustic, Mercaptan Conversion Caustic, Merox Extractor and Settler Tower Bottoms Streams, V205 Oxidizer Tower Feed, Sodium Hydroxide and Cobalt Catalyst Process Solution, Mercaptan Conversion Solution		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Water	7732-18-5	55-84
2) Sodium hydroxide	1310-73-2	15-30
3) Disulfides, Dialkyl and Di-pH, Naphtha Sweetening	68955-96-4	1-10
4) Hydrogen sulfide	7783-06-4	0 1-5
5) Methyl mercaptan	74-93-1	0 01-10
6) Ethyl mercaptan	75-08-1	0-5

Merx Rich Caustic**SECTION 3: HAZARDS IDENTIFICATION**

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact Eye contact Inhalation Skin Absorption

Signs and Symptoms of Acute Exposure

Inhalation	<p>Inhalation is not considered a normal route of exposure for this aqueous solution. However, breathing high concentrations of mist or liquid droplets may cause respiratory tract irritation, mucous membrane tissue burns, and possibly, pulmonary edema and chemical pneumonia.</p> <p>Generated methyl mercaptan and/or ethyl mercaptan vapors may cause central nervous system depression and/or peripheral nerve damage with repeated exposures.</p> <p>Generated vapor may be harmful or fatal if inhaled! Inhalation of the released vapor may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath. NIOSH has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H₂S) are immediately dangerous to life and health. At concentrations above 500 ppm, H₂S and/or methyl mercaptan cause unconsciousness and respiratory paralysis leading to coma and/or death. (See Section 11.)</p>
Eye Contact	<p>Irritating and may injure eye tissue if not promptly removed. The severity of the effects depend on the concentration of the sodium hydroxide and how soon after exposure the eyes are washed.</p> <p>Generated vapor may cause moderate to severe eye irritation and photophobia (light sensitivity) upon short-term exposure. Severity depends upon the concentrations of hydrogen sulfide, methyl mercaptan, and ethyl mercaptan and duration of exposure.</p>
Skin Contact	<p>May be irritating or corrosive to the skin. Irritation may follow an initial delay between the time that the exposure occurs and the sense of irritation begins. This latency period can vary as much as several hours for a dilute solution (0.04 wt % caustic) to minutes with more concentrated solutions. Prolonged or repeated contact, even to dilute concentrations of sodium hydroxide solutions may cause a high degree of permanent tissue destruction.</p> <p>Generated hydrogen sulfide and methyl mercaptan vapor can be absorbed through the skin to produce toxic effects. If the skin is damaged, absorption increases.</p>
Ingestion	<p>If swallowed, this material may cause severe pain, nausea, vomiting, and/or bloody diarrhea, in addition to a burning sensation in the mouth, throat, and digestive tract. Depending upon caustic solution concentration, ulceration of the gastrointestinal tract may also occur. This material is toxic and may be fatal.</p>
Chronic Health Effects Summary	<p>Prolonged and/or repeated contact can defat the skin and may produce moderate to severe irritation and inflammation and/or alkali burns. Repeated exposure to mists or aerosols of sodium hydroxide can produce either obstructive airway disease or a tolerance to its respiratory irritant effects.</p> <p>Subchronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H₂S distinct from its acute and subchronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.)</p>
Conditions Aggravated by Exposure	<p>Personnel with pre-existing eye, skin, or gastrointestinal disorders or chronic respiratory diseases should avoid exposure.</p>
Target Organs	<p>The substance is toxic to eyes, skin, mucous membranes, lungs, and possibly the blood, heart, and/or nervous systems.</p>
Carcinogenic Potential	<p>This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.</p>

Merox Rich Caustic

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input checked="" type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input checked="" type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with water under a cool or cold shower for at least 15 minutes while removing contaminated shoes and clothing. Gently and thoroughly wash contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases, and groin area. Seek medical attention if tissue appears damaged or if irritation or pain persists. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.

Notes to Physician

If after exposed skin has been washed gently with running water and non-abrasive soap, one may neutralize severely irritated or burned tissue with a **dilute solution of boric acid or acetic acid**.

Inhalation overexposure can produce other toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

Nitrite as an antidote for acute **hydrogen sulfide** intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Not applicable or Extremely Flammable, if improperly handled!		
Flash Point Method	Not applicable or AP -73°C (-100°F) for H ₂ S		
Lower Flammable Limit	Not applicable or AP 4.0% for H ₂ S and Methyl mercaptan	Upper Flammable Limit	Not applicable or 45% for H ₂ S
Autoignition Temperature	Not applicable or AP 260°C (500°F) for H ₂ S		
Hazardous Combustion Products	Contact with some metals can generate extremely flammable hydrogen gas		
Special Properties	High heat, hot surface contact, or mixing with acids may spring extremely flammable H ₂ S and/or mercaptan vapors out of this solution. Adding this material directly to unbuffered water may cause an exothermic reaction sufficient enough to make the water boil.		

Merox Rich Caustic

Extinguishing Media	Non-combustible, if handled and stored properly Use extinguishing media suitable for the surrounding fire In an advanced or massive fire, evacuate area and fight fire from a safe distance or a protected location. <i>Approach fire from upwind. Use unmanned monitors and hoseholders to keep cooling streams of water on fire-exposed cylinders or tanks until well after the fire is out</i> If possible, isolate materials not yet involved in the fire and protect personnel Move containers away from fire area if it can be done without risk
Fire Fighting Protective Clothing	This material is not expected to burn However, in the event that gases are being generated or surrounding materials are involved in a fire, firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Avoid contact with damaged containers or spilled material unless wearing appropriate protective clothing *Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas* Absorb or cover with dry earth, sand, or other non-combustible material and transfer to containers All clean-up materials should be removed for proper treatment or disposal For large spills, dike far ahead of spill to maximize later product recovery or disposal Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and proper protective clothing during cleanup operations. This material may react strongly with acids Never flush to the sewer In urban areas, cleanup spill as soon as possible, in natural environments, cleanup on advice from specialists to minimize physical habitat damage. If appropriate, neutralize with a dilute solution of **boric acid or acetic acid** A vacuum truck may be used to collect the bulk Spills on other than pavement may be handled by removing the affected soil and placing it into approved containers for later disposal Comply with all laws and regulations

SECTION 7: HANDLING AND STORAGE

Handling	Do not breathe mist or vapor Do not get in eyes, on skin, or on clothing Wear suitable personal protective equipment to prevent eye and skin contact Wash thoroughly after handling Danger! Corrosive Liquid and/or Poisonous and Flammable Gas! Do NOT breathe mist or vapor, it may contain sodium hydroxide, hydrogen sulfide (H₂S), and/or mercaptans Odor is not an adequate warning of potentially hazardous air concentrations Use only with adequate ventilation and personal protective equipment Do not allow material to contact eyes, skin or other tissues, and clothing Wear corrosion-resistant protective work clothing and chemical splash goggles and face shield when contact is anticipated Releases of this material can cause atmospheres to become oxygen deficient and/or create an immediate fire or explosion hazard Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for H ₂ S concentrations and flammability When performing repairs or maintenance on contaminated equipment, keep unnecessary persons from the hazard area. Eliminate heat and other ignition sources Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8 Drain and purge equipment as necessary to remove material residues However, empty containers may still contain corrosive and poisonous residue
Storage	Store in containers appropriate for concentrated or dilute caustic solutions and away from acids Diluted material may accelerate corrosion of metal containers Store and transport in accordance with all applicable laws Do not store this material in unlabeled containers <i>Keep containers tightly closed and stored in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles</i> If possible, store containers in a separate safety cabinet or room The H ₂ S component of this material is corrosive to most metals It can cause steel pipe to become blistered, pitted, and brittle Metal components used for storage should be resistant to sulfide stress cracking (See appropriate API and NACE standards.)

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls	No special ventilation is required under normal conditions of use Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Where hydrogen sulfide and/or mercaptans may be generated, special ventilation will be required Ensure that an emergency eye wash station and safety shower are near the work-station location
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Merox Rich Caustic**Personal Protective Equipment**

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

**Eye Protection**

Safety glasses with side shields are recommended as a minimum protection. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Thermal protection should be provided if the solution has a temperature above 120 degrees F. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact. Use of chemical-resistant gloves (e.g., PVC, neoprene, rubber, or vinyl) is required. Thermal protection should be used whenever the solution has a temperature above 120 degrees F. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.

Body Protection

Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (e.g., vinyl, Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. Thermal protection should be provided when the solution has a temperature above 120 degrees F. If general contact occurs, IMMEDIATELY remove soaked clothing and shower thoroughly. Contaminated leather goods should be removed immediately and discarded.

Respiratory Protection

Misting or vapor generation are not expected under normal conditions of use. Therefore, the need for respiratory protection from **diluted sodium hydroxide** is not anticipated under normal use conditions and with adequate ventilation. If generated **hydrogen sulfide or mercaptans** are present at concentrations above applicable workplace exposure levels, or when they are anticipated, a full-face supplied air respirator with escape bottle or a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA) is required. Respirator use should follow OSHA requirements (29 CFR 1910.134 and 1910.1028) or equivalent (e.g., ANSI Z88.2).

General Comments

Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners. Exposure standards/control limits for some of the components apply to airborne concentrations of dust, and are not truly applicable to liquid solutions. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Releases of bound **hydrogen sulfide and/or mercaptans** may create flammable, explosive, and/or oxygen-deficient atmospheres (LT 19.5 Vol % in air). DO NOT ENTER such areas or confined spaces without taking special precautions including monitoring for oxygen deficiency and flammability. Warning! Odor is an inadequate warning for hazardous conditions. Air purifying respirators offer no protection against oxygen deficiency, hydrogen sulfide, methyl mercaptan,

Occupational Exposure Guidelines**Substance****Applicable Workplace Exposure Levels**

1) Sodium hydroxide	CEIL 2 (mg/M ³) from ACGIH (TLV) [1999] CEIL 2 (mg/M ³) from OSHA (PEL) [1989] TWA 2 (mg/M ³) from OSHA (PEL) [1977]
2) Hydrogen sulfide	TWA 10 STEL 15 (ppm) from ACGIH (TLV) [1999] TWA 5 (ppm) from ACGIH (TLV) [2000] TWA 10 STEL 15 CEIL 20 (ppm) from OSHA (PEL) [1989]
3) Methyl mercaptan	TWA 0.5 (ppm) from ACGIH (TLV) [1999] CEIL 10 (ppm) from OSHA (PEL) [1989]
4) Ethyl mercaptan	TWA 0.5 (ppm) from ACGIH (TLV) [1999] CEIL 10 (ppm) from OSHA (PEL) [1989]

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Color	Light to dark blue	Odor	Odorless to strong, unpleasant, and possibly distinctive of rotten eggs or skunk
Specific Gravity	1.01 to 1.22 (Water = 1)	pH	12.0 to 14.0 [Highly Basic]	Vapor Density	Not applicable
Boiling Point/Range	100° to 113°C (212° to 235°F)	Melting/Freezing Point			-32° to 0°C (-25° to 32°F)

Merox Rich Caustic

Vapor Pressure	110 to 145 mm of Hg @ 60°C (140°F)	Viscosity (cSt @ 40°C)	Not available
Solubility in Water	Completely soluble in cold water, but causes an exothermic reaction	Volatile Characteristics	Negligible volatility in proper storage.
Additional Properties	Boiling point and melting point temperatures increase with the level of sodium hydroxide present A 7.5% solution of sodium hydroxide has a pH of 14.0		

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Caustic solutions may react with strong acids, releasing heat, hydrogen sulfide, mercaptans, and other acid gases. Contact with some metals can generate extremely flammable hydrogen gas. Avoid direct contact with water, leather, wool, and organic halogen or nitro compounds.		
Materials Incompatibility	Strong acids, some heavy metals, and some organic chemicals. Caustic solutions are corrosive to tin, aluminum, zinc, and alloys containing these metals and will react violently with their powdered forms. Toxic carbon monoxide gas can form when caustic solutions contact with reducing sugars, food, and beverage products in enclosed spaces and it can cause death. Appropriate tank entry procedures must be followed.		
Hazardous Decomposition Products	None		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data**Sodium Hydroxide**

DERMAL (LD50) Acute 1,350 mg/kg [Rabbit]
INTRAPERITONEAL (LD50) Acute 40 mg/kg [Mouse]

Hydrogen sulfide

GAS (TCLo) Acute 10 ppm for 15 minutes (Human) - Eye irritation
GAS (TCLo) Acute 50 to 100 ppm for 15 minutes (Human) - Respiratory irritation
GAS (LC100) Acute 600 to 750 ppm for 30 minutes (Human) - Respiratory paralysis and death
GAS (LCLo) Acute 5,700 ug/kg for 8 hours (Human) - Chronic pulmonary edema, coma, and death

Methanethiol (Methyl mercaptan)

GAS (LC50) Acute 675 ppm for 4 hours [Rat] - Hypermotility, diarrhea, and reduced respiration
GAS (LC50) Acute 6,530 ug/m³ for 2 hours [Mouse]

Ethanethiol (Ethyl mercaptan)

GAS (LC50) Acute 2,770 ppm for 4 hours [Mouse] - Excitement, motor activity changes, and cyanosis
GAS (LC50): Acute 4,420 ppm for 4 hours [Rat] - Excitement, spastic paraparesis, and cyanosis.
ORAL (LD50) Acute 682 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis.
INTRAPERITONEAL (LD50) Acute 226 mg/kg [Rat] - Muscle weakness, ataxia, and cyanosis

Sodium hydroxide (Lye) is strongly alkaline and very corrosive to many organic compounds. If ingested, sodium hydroxide can cause severe pain, bloody diarrhea, cardiovascular collapse, and death. It is a severe eye, skin, and respiratory tract irritant and in an undiluted form it can burn tissue upon contact. It gelatinizes the tissue, forming deep and painful lesions. Squamous cell carcinomas (cicatrical tumors) frequently develop in healing tissue at the site of chemical burns or in scar tissue after a delay of 10 to 20 years. Sodium hydroxide has also been shown to cause chromosomal aberrations in hamster ovary cells and grasshoppers. In general, however, pH alterations produce false positive results in short-term genetic assays.

Hydrogen sulfide (H₂S) causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (LT 20 ppm), H₂S has an odor of rotten eggs. At higher concentrations (GT 50 ppm), H₂S odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more H₂S are immediately dangerous to life and health. For the average human adult, exposure to H₂S concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of H₂S is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to H₂S. An inhalation study using rats exposed to 100 ppm of H₂S for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring slowed developmental physical effects.

Merox Rich Caustic

Methyl and ethyl mercaptans act as respiratory poisons by inhibiting the respiratory control center in the brain and cellular respiration, but only at concentrations exceeding 50 ppm in air. At lower chronic exposures, they can cause pulmonary edema, hemolytic anemia, methemoglobinemia, and kidney and/or liver damage. They are also eye irritants and have been shown to produce positive responses in various mutagenic assays.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage, however, due caution should be exercised to prevent the accidental release of this material into the environment. The sodium hydroxide and mercaptan components are toxic by ingestion. Contaminated food stuffs must not be eaten by humans or animals.
Environmental Fate	This material is soluble in water and is expected to readily disperse in marine environments. Caustic solutions have produced slight to moderate toxicity in laboratory tests with aquatic organisms. It is expected to be strongly alkaline. If released to surface water, it will cause the pH rise depending upon the buffering capacity of the waterbody. Aquatic organisms become increasingly stressed as pH concentration exceeds 9.0, with many species being intolerant of pH of 10.0 or higher. Substances in this mixture do not bioaccumulate.
	For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovery and reuse, rather than disposal, should be the ultimate goal for handling this corrosive alkaline material. However, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

DOT Status	This material is regulated by the U.S. Department of Transportation (DOT)		
Proper Shipping Name	Corrosive liquid, toxic, n.o.s. (Sodium hydroxide, Methyl mercaptan)		
Hazard Class	DOT CLASS. 8 (Corrosive liquid)	Packing Group(s)	PG II or PG III
		UN/NA ID	UN2922
Reportable Quantity	A Reportable Quantity (RQ) substance component in this stream which requires DOT HAZMAT bill-of-lading display is Sodium hydroxide and Methyl mercaptan		
Placards			Emergency Response Guide No. 154
		HAZMAT STCC No.	49 352 30
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

Merox Rich Caustic**SECTION 15: REGULATORY INFORMATION**

TSCA Inventory	This product and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. This material might contain the following chemical substance subject to this statute Methanethiol (Methyl Mercaptan) [CAS No. 74-93-1]
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2 This material would be classified under the following hazard categories Acute (Immediate) Health, Chronic (Delayed) Health, and Reactivity Hazards
SARA 313	This material contains the following components in concentrations which might be at or above de minimis levels and are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 Hydrogen sulfide [CAS No. 7783-06-4] concentration: 0.1 to 5% Methanethiol (Methyl mercaptan) [CAS No. 74-93-1] concentration: 0.01 to 10% Ethanethiol (Ethyl mercaptan) [CAS No. 75-08-1] concentration: 0 to 5%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4 As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4 Chemical substances present in this material subject to this statute are. Sodium Hydroxide (RQ = 1000 lbs. [453.6 kg]) concentration: 15 to 30% Methanethiol (Methyl mercaptan) (RQ = 100 lbs. [45.4 kg]) concentration: 0.01 to 10%
CWA	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA)
California Proposition 65	This material does not contain any ingredients for which the State of California has found to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5
New Jersey Right-to-Know Label	For New Jersey labeling refer to components listed in Section 2
Additional Regulatory Remarks	In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds Chemical substances which may be present in this material that are subject to this statute are Hydrogen sulfide, Methyl mercaptan (Methanethiol), and Ethyl mercaptan (Ethanethiol).

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	1 0
Revision Date	09/01/2000
Print Date	Printed on 09/05/2000

ABBREVIATIONS

AP = Approximately	EQ = Equal	> = Greater Than	< = Less Than	NA = Not Applicable	ND = No Data	NE = Not
ACGIH = American Conference of Governmental Industrial Hygienists	AIHA = American Industrial Hygiene Association					
IARC = International Agency for Research on Cancer	NTP = National Toxicology Program					
NIOSH = National Institute of Occupational Safety and Health	OSHA = Occupational Safety and Health Administration					
NPCA = National Paint and Coating Manufacturers Association	HMIS = Hazardous Materials Information System					
NFPA = National Fire Protection Association	EPA = Environmental Protection Agency					

Merox Rich Caustic**DISCLAIMER OF LIABILITY**

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****



2 Depropanizer Bottoms

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0986
Revision Date 2/28/2003

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State	Highly Volatile Liquid		
Color	Colorless liquid and vapor. Forms white cloud with sudden release.	Odor	Rotten eggs. (Hydrogen sulfide odor).

DANGER!

Extremely flammable compressed gas/liquid.
Vapor may cause flash fire or explosion.
High pressure and rapid diffusion hazard.
Contact with liquid may cause frostbite or freeze burns.
High concentrations of vapor reduce oxygen available for breathing.
May increase the heart's susceptibility to arrhythmias (irregular beats).

HARMFUL IF INHALED

Contains Methyl Mercaptan.
Vapors have a strong, offensive odor.
High concentrations can cause unconsciousness and coma.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	4	4
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



SECTION 1: IDENTIFICATION

Trade Name	2 Depropanizer Bottoms (LCRC)	Technical Contact	(800) 525-4692
Product Number	Not available	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Liquefied Petroleum Gas (LPG or LP-Gas)		
Synonyms	Not available.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) n-Butane	106-97-8	30-60
2) Iso-Butane	75-28-5	10-25
3) Pentanes, all isomers	Mixture	10-20
4) Butenes, all isomers	Mixture	6-14
5) C6 and heavier hydrocarbons	Mixture	10-20
6) Alkyl mercaptans	74-93-1	0.03-1

2 Depropanizer Bottoms

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	One or more components of this gas mixture are "simple asphyxiants" (see Section 8). Their vapors can displace the amount of oxygen in air available to breathe below that necessary to sustain life, especially if working in confined spaces. Breathing vapors may also irritate the respiratory tract and cause central nervous system (CNS) depression. Symptoms may include headache, dizziness, slurred speech, excitation or giddiness, nausea, blurred vision, memory loss, drowsiness, fatigue, rapid or difficult breathing, confusion, vertigo, loss of consciousness, convulsions, coma, and even death, depending upon the concentration and duration of exposure. This material contains alkyl mercaptans. Symptoms of exposure include strong and disagreeable odor, irritation of eyes and respiratory system. High concentrations can produce narcosis and hematological effects.
Eye Contact	This gas is non-irritating; however, direct contact with pressurized or liquefied gas may result in severe, possibly permanent, eye tissue damage commonly referred to as a "freeze burn."
Skin Contact	Non-irritating; but, direct contact with an expanding gas may produce skin damage from frostbite or freeze burns.
Ingestion	Ingestion is not an applicable route of exposure for gases.
Chronic Health Effects Summary	Chronic inhalation to components of this gas may increase the heart's susceptibility to irregular beating and its sensitivity to the effects of Epinephrine (Adrenaline)-like drugs.
Conditions Aggravated by Exposure	Personnel with pre-existing chronic respiratory diseases, central nervous system (CNS) disease, or cardiovascular conditions should avoid exposure. Persons who are compromised in their ability to use oxygen, such as asthmatics and those with reduced pulmonary function or anemia, may be more sensitive to excess concentrations of "simple asphyxiants".
Target Organs	This material may cause damage to the following organs: cardiovascular system, central nervous system (CNS).
Carcinogenic Potential	This product does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
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2 Depropanizer Bottoms

Eye Contact	If tissue is frozen, immediately seek medical attention. If tissue is not frozen, check for and remove contact lenses. Then, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids. If pain, redness, swelling, tearing, or light sensitivity persist, obtain medical attention as soon as possible. Do not use eye ointment unless directed by a physician.
Skin Contact	In the event of frostbite or freeze burn, the affected frozen tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water. Rewarming should continue until natural skin tones return to the affected area. Seek medical attention if tissue appears damaged or if pain persists.
Ingestion	Due to the volatile nature of this material, ingestion is not a likely route of entry.
Notes to Physician	<p>If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Monitor arterial blood gases and chest x-ray in cases with significant exposure. If contact with pressurized or liquefied gas causes frostbite of the eyes, early ophthalmologic consultation is recommended.</p> <p>This material may also make the heart more susceptible to arrhythmias. Catecholamines such as epinephrine and other similar sympathomimetic drugs should be reserved for emergencies and then used only with special precaution. If used, monitor the heart action closely. Consider use of other drugs with less arrhythmogenic potential.</p>

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	Flammable gas.		
Flash Point Method	CLOSED CUP: <-40°C (-40°F).		
Lower Flammable Limit	AP 1.6 %	Upper Flammable Limit	AP 8.4 %
Autoignition Temperature	Not available.		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, unburned hydrocarbon vapors, and trace oxides of sulfur.		
Special Properties	This gas is flammable at well below ambient temperatures and readily forms flammable mixtures with air. Exposed to an ignition source, it will burn in the open and may cause a flash fire, or in enclosed spaces, it can ignite with explosive force. Keep away from all ignition sources! Being heavier than air, its flammable vapors can travel long distances close to the ground to an ignition source, and then flash back.		
Extinguishing Media	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! If the source cannot be shut off immediately, cool tanks, containers, equipment, and other structural surfaces exposed to the fire with water fog or spray in order to prevent metal fatigue, pressure build-ups, autoignition, and/or explosions. Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Use water, dry chemical, carbon dioxide (CO ₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

2 Depropanizer Bottoms

Extremely Flammable Compressed Gas! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel to an area upwind. Remove all potential ignition sources. Safely stop the source gas flow using non-sparking tools. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. Closed gas systems form white-colored frost at the point of a leak. A liquid spill will vaporize forming a cold, dense vapor cloud that does not readily disperse. Water spray may be used to reduce vapors. Avoid entering a vapor cloud even when wearing proper respiratory equipment and fire-resistant protective clothing.

If tanks or tank cars are involved, evacuate all non-essential personnel to at least 1/4 mile in all directions. Secure the area and control access. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. Allow free liquid to evaporate or burn off. This gas or waste mixtures containing this gas should not be allowed to enter drains or sewers where there is danger of their vapors being ignited by a remote ignition source. Some releases must be reported to the National Response Center (800/424-8802).

SECTION 7: HANDLING AND STORAGE

Handling

This gas mixture contains "simple asphyxiants". Odor is not an adequate warning of potentially hazardous air concentrations. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Refer to applicable OSHA, DOT, and local regulations concerning handling, storage, and shipment of mixed gases. If upon inspection, a cylinder or other container is found to be in poor operating condition, promptly contact the supplier. Excessive pressure can cause explosive decomposition at the cylinder head or relief valve resulting in a dangerous gas release. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Prevent liquid entrapment in closed systems. Drain and purge equipment, as necessary, to remove material residues. Ground all containers when transferring material.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow vaporizing material to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat or any other potential ignition sources. Segregate from oxidizers and other combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed.

Always chain gas cylinders securely in the up-right position and avoid placement in high traffic areas. Store and use these cylinders or other containers in a cool, well-ventilated place. Storage areas should not exceed 100°F. Protect from dampness, salt, or corrosive chemicals. Do not drag, roll, or slide cylinders. Valve caps should remain on cylinders not connected for use. Separate full containers from empty ones. Empty and partially filled containers should be returned to the supplier. Do not puncture or incinerate cylinders.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Both local exhaust and general room ventilation may be essential in work areas to prevent accumulation of potentially explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are located near the work-station location.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

2 Depropanizer Bottoms

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection	Use chemical-type goggles and face shield (ANSI Z87.1 or approved equivalent) when handling liquefied gases. Safety glasses equipped with side shields or face shield are recommended when vapor is being discharged or whenever handling high-pressure cylinders and piping systems.
Hand Protection	Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with cold liquid, solid, or vapors.
Body Protection	Prevent potential skin contact with cold liquid or vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases and gas/liquids.
Respiratory Protection	Odor is not an adequate warning for potentially hazardous air concentrations. For unknown vapor concentrations, use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator, if adequate protection is provided. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
General Comments	For an explanation about some of the occupational exposure limits shown below, refer to the definition of " Simple Asphyxiant " presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents handbook. Releases of these gases can result in dangerous conditions such as fire and explosive hazards, or atmospheres with inadequate amounts of oxygen to breathe (i.e., less than 19.5 Vol.% oxygen in air). DO NOT ENTER such areas or confined spaces without special safety procedures including appropriate monitoring for flammability and oxygen deficiency.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) n-Butane	ACGIH (United States). TWA: 800 ppm
2) Iso-Butane	ACGIH (United States). TWA: 800 ppm
3) Pentanes, all isomers	ACGIH (United States). TWA: 600 ppm OSHA (United States). TWA: 1000 ppm
4) Alkyl mercaptans	ACGIH TLV (United States). TWA: 0.5 ppm OSHA PEL Z2 (United States). CEIL: 10 ppm
5) Liquefied Petroleum Gases	ACGIH (United States). TWA: 1000 ppm OSHA (United States). TWA: 1000 ppm

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Highly Volatile Liquid	Color	Colorless liquid and vapor. Forms white cloud with sudden release.	Odor	Rotten eggs. (Hydrogen sulfide odor).
Specific Gravity	0.52 (Water = 1)	pH	Not Applicable.	Vapor Density	Not available.
Boiling Range	Not available.			Melting/Freezing Point	Not available.
Vapor Pressure	Not available.			Viscosity (cSt @ 40°C)	Not available

2 Depropanizer Bottoms

Solubility in Water Not available.

**Volatile
Characteristics**

This material is usually stored as a liquid. If open to the atmosphere it will evaporate quickly to form a vapor cloud.

Additional Properties No additional information.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions. Polymerization can occur under conditions of extremely high temperature and pressure.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen. Alkane hydrocarbons and chlorine gas mixtures have produced explosions.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the **Emergency Overview on Page 1** and the **Hazards Identification in Section 3** of this MSDS.

Toxicity Data

n-Butane:

INHALATION (LC50): Acute: 660000 mg/m³ 4 hour(s) [Rat]. 680000 mg/m³ 2 hour(s) [Mouse].

An n-butane exposure of 5,000 ppm in air has been shown to affect the heart in dogs, causing lower contractile force and other effects. Also, butane may decrease the myocardial threshold to epinephrine-induced arrhythmias.

Iso-Butane:

INHALATION (LC50): Acute: 57000 ppm 0.25 hour(s) [Rat].

Laboratory animals have exhibited a higher degree of narcosis when exposed to both isobutane and butylene (additive effect), than the degree of narcosis exhibited following exposure to either gas alone.

Pentanes, all isomers:

n-Pentane was associated with cardiac sensitization in rabbits at a concentration of 100,000 ppm in air within four hours of exposure. Pentane can act as an anesthetic by inhalation. Mice exhibited signs of respiratory irritation and mild central nervous system effects at concentrations of 32,000 to 69,000 ppm for five minutes.

Butenes, all isomers:

Butenes are simple asphyxiants. At high concentrations they depress the central nervous system (CNS), producing anesthetic effects. Cardiac sensitization effects have been reported in animal studies. CNS effects are not expected to occur at concentrations less than the lower flammable limit, (1.8% in air).

Alkyl mercaptans:

At concentrations above 50 ppm, methyl and ethyl mercaptans can inhibit respiration. Chronic exposures have been associated with pulmonary edema, hemolytic anemia, methemoglobinemia, kidney and liver damage. Also, these mercaptans can cause eye irritation.

Liquefied Petroleum Gases:

When a 4-hour rabbit inhalation screen test was run on a liquefied petroleum gas, no deaths occurred; however, the animal's heart muscles became sensitized to sympathomimetic drugs such as epinephrine (adrenaline).

2 Depropanizer Bottoms

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this material. Releases are expected to cause only localized non-persistent environmental damage.
Environmental Fate	Refined liquefied petroleum hydrocarbon gases are essentially insoluble in water (LT 0.1%); and therefore, this material will not cause harm to aquatic life. These liquefied gas mixtures will normally evaporate rapidly if spilled. At ambient temperatures and pressure, this material will readily vaporize. Olefin components may contribute to generation of atmospheric smog.

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Material residues may be a RCRA Hazardous Waste on disposal due to its ignitibility characteristic (D001). Allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. If possible and permissible, this material may be disposed of as an auxiliary fuel or by controlled burning in a properly designed flare or incinerator. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14: TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Liquefied petroleum gas (n-Butane, Iso-Butane)		
Hazard Class	2.1	Packing Group(s)	A Packaging Group has not been assigned for this product.
		UN/NA ID	1075
Reportable Quantity	Not determined.		
Placards		Emergency Response Guide No.	115
		HAZMAT STCC No.	490575
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

2 Depropanizer Bottoms

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Sudden Release of Pressure, Acute (Immediate) Health Hazard.
SARA 313	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: No components were identified.
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. This product or refinery stream is not known to contain chemical substances subject to this statute. However, it is recommended that you contact state and local authorities to determine if there are any other reporting requirements in the event of a spill.
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This product is not known to contain the any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	1.00
Revision Date	2/28/2003
Print Date	Printed on 2/28/2003.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

2 Depropanizer Bottoms

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***** END OF MSDS *****



Kerosene with DSO

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0990
Revision Date 2/28/2003

RS0990
HFR# 220
BRU/Menox
Old HDS/534 Depe
HAZCOM 2
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IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Clear to light amber. **Odor** Pungent, unpleasant odor similar to onions.

WARNING!

Combustible liquid; vapor may cause flash fire.
Harmful or fatal if swallowed - can enter lungs and cause damage.
Mist or vapor can irritate the respiratory tract.
Liquid contact can cause eye or skin irritation.
May be harmful if inhaled or absorbed through the skin.
Overexposure can cause central nervous system (CNS) depression and/or other target organ effects.
Spills may create a slipping hazard.
Contains Disulfide Oil. Vapors have a strong offensive odor which may cause headaches, nausea, and vomiting.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	0
Fire Hazard	2	2
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



SECTION 1: IDENTIFICATION

Trade Name	Aviation Kerosene	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Kerosene		
Synonyms	Not available.		

SECTION 2: COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
1) Hydrodesulfurized Kerosine (Petroleum)	64742-81-0	0-100
2) Disulfides, Dialkyl and Di-Ph, Naphtha Sweetening	68955-96-4	0.2-1
3) Nonane, all isomers	Mixture	20-30
4) Ethylmethylbenzenes (Ethyltoluenes)	25550-14-5	1-3
5) Naphthalene	91-20-3	0-2
6) Trimethylbenzenes, all isomers	25551-13-7	0-2
7) Biphenyl (Diphenyl)	92-52-4	0-2
8) Ethylbenzene	100-41-4	0-1
9) Xylene, all isomers	1330-20-7	0-1

Kerosene with DSO

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Inhalation.

Signs and Symptoms of Acute Exposure

- Inhalation** Breathing mist or vapors concentrations well above occupational exposure levels can irritate the mucous membranes of the nose, throat, bronchi, and lungs, and may cause transient central nervous system (CNS) depression. CNS symptoms include headache, dizziness, nausea, intoxication, blurred vision, slurred speech, flushed face, confusion, weakness, fatigue, loss of consciousness, convulsions, coma, and death, depending on the concentration and/or duration of exposure.
- Eye Contact** This product can cause eye irritation with short-term contact with liquid, mists or vapor. Symptoms include stinging, watering, redness, and swelling. In severe cases, permanent eye damage can result.
- Skin Contact** Animal test results on similar materials suggest that this product can cause moderate to severe skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. Also, certain components of this material may be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases. Prolonged and/or repeated contact may cause severe dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage.
- Ingestion** If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness, and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).

Due to its light viscosity, there is a danger of aspiration into the lungs during vomiting. Aspiration of a small amount of liquid can cause severe pulmonary edema and lipid or chemical pneumonia which can result in death. Progressive CNS depression, respiratory insufficiency, and ventricular fibrillation may also result in death.

Chronic Health Effects Summary Secondary effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction.

This product contains petroleum middle distillates similar to those shown to produce skin tumors on laboratory rodents following repeated application. All tumors appeared during the latter portion of the typical 2-year lifespan of the animals. Certain studies have shown that washing the animal's exposed skin with soap and water between treatments greatly reduces the potential tumorigenic effects. These effects are unlikely to occur if good personal hygiene is practiced.

This material and/or its components have been associated with developmental and/or reproductive toxicity, genotoxicity, immunotoxicity, and carcinogenicity. Refer to Section 11 of this MSDS for additional health-related information.

Conditions Aggravated by Exposure Medical conditions aggravated by exposure to this material may include skin disorders, chronic respiratory diseases, neurological conditions, liver or kidney dysfunction.

Target Organs This material may cause damage to the following organs: kidneys, liver, upper respiratory tract, skin.

Carcinogenic Potential This material may contain ethylbenzene and naphthalene at concentrations above 0.1%. IARC has identified ethylbenzene and naphthalene as possibly carcinogenic to humans (Group 2B) based on laboratory animal studies.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input checked="" type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Kerosene with DSO

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. Keep the affected individual warm and at rest.
Eye Contact	Check for and remove contact lenses. Flush eyes with cool, clean, low-pressure water for at least 15 minutes while occasionally lifting and lowering eyelids. Do not use eye ointment unless directed to by a physician. Seek medical attention if excessive tearing, irritation, or pain persists.
Skin Contact	Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
Notes to Physician	Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration/lipoid or chemical pneumonitis hazard. As a result, induction of emesis is not recommended. Consider administration of an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by placement in Trendelenburg and left lateral decubitus position or by cuffed endotracheal intubation. If vital signs become abnormal or symptoms develop, obtain a chest x-ray and liver function tests. Antibiotics are indicated if pulmonary bacterial infection occurs. Monitor for cardiac function and arterial blood gases in severe exposure cases.

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-II combustible liquid.		
Flash Point Method	CLOSED CUP: 38°C (100°F). (Pensky-Martens. (minimum))		
Lower Flammable Limit	AP 0.7 %	Upper Flammable Limit	AP 5 %
Autoignition Temperature	Not available.		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and trace oxides of sulfur and/or nitrogen.		
Special Properties	Combustible Liquid! This material releases vapors when heated above ambient temperatures. Vapors can cause a flash fire. Vapors can travel to a source of ignition and flashback. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. Use only with adequate ventilation. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.		

Kerosene with DSO

Protection of Fire Fighters Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid enter sewers or waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Combustible Liquid! Release can result in a fire hazard. Evacuate all non-essential personnel from release area. Establish a regulated zone with site control and security. Eliminate all ignition sources. Stop the leak if it can be done without risk. A vapor-suppressing foam may be used to reduce vapors. Properly bond or ground all equipment used when handling this material. Avoid skin contact. Do not walk through spilled material. Verify that responders are properly trained and wearing appropriate personnel protective equipment. Dike far ahead of a liquid spill. Do not allow released material to enter waterways, sewers, basements, or confined areas. This material will float on water. Absorb or cover with dry earth, sand or other non-combustible material. Use clean, non-sparking tools to collect absorbed material. Place spent sorbent materials, free liquids and other clean-up debris into proper waste containers for appropriate disposal. Certain releases must be reported to the National Response Center (800/424-8802) and state or regulatory authorities. Comply with all laws and regulations.

SECTION 7: HANDLING AND STORAGE

Handling

Combustible Liquid!

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Special precautions, such as reduced loading rates and increased monitoring, must be observed during "switch loading" operations (i.e., loading this material in tanks or shipping compartments that previously containing gasoline or similar low flash point products).

Fire hazard increases as product temperature approaches its flash point. Use non-sparking tools. Keep container closed and drum bungs in place. Remove spillage immediately from walking areas. Do not handle or store near heat, sparks or other potential ignition sources. Do not handle or store with oxidizing agents. Avoid breathing mist or vapor. Never siphon by mouth. Do not taste or swallow. Avoid contact with eyes, skin and clothing. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure levels. Avoid water contamination. Wash thoroughly after handling. Prevent contact with food or tobacco products.

Cutting or welding of empty containers can ignite residues with explosive force. Do not pressurize or expose empty containers to flames, sparks or heat. Observe all label warnings and precautions. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product. Return empty drums to a qualified reconditioner. When performing repairs and maintenance on contaminated equipment, keep unnecessary persons from hazard area. Eliminate heat, flame and other potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Storage

Store in a cool, dry, well-ventilated place. Keep containers tightly closed. Do not store this product near heat, flame or other potential ignition sources. Do not store with oxidizers. Do not store this product in unlabeled containers. Do not puncture or incinerate containers. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers or waste residues of this product. Ground all equipment containing this material. All electrical equipment in areas where this material is stored or handled must meet all applicable requirements of the NFPA's National Electrical Code (NEC). Store and transport in accordance with all applicable laws.

Kerosene with DSO

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Eye Protection Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.

Hand Protection Avoid skin contact. Use gloves (e.g., disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.

Body Protection Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.

Respiratory Protection A full-face supplied air pressure-demand respirator with escape bottle or a pressure-demand self-contained, breathing apparatus (SCBA) is required. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Kerosene (Petroleum)	NIOSH TWA: 100 mg/m ³

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Clear to light amber.	Odor	Pungent, unpleasant odor similar to onions.
Specific Gravity	AP 0.82 (Water = 1)	pH	Not Applicable.	Vapor Density	AP 4 (Air = 1)
Boiling Range	>150°C (>302°F)			Melting/Freezing Point	AP -32°C (-26°F)
Vapor Pressure	<0.3 kPa (<2 mmHg) (at 20°C)			Viscosity (cSt @ 40°C)	Not available
Solubility in Water	Very slightly soluble in cold water.			Volatile Characteristics	AP 825 g/l VOC (W/V)
Additional Properties	Viscosity (ASTM D2161) = 30 - 40 SUS @ 100° F				

Kerosene with DSO

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization Not expected to occur.
Conditions to Avoid	Keep away from heat, flame and other potential ignition sources. Keep away from strong oxidizing conditions and agents.	
Materials Incompatibility	Strong acids, alkalies, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide and oxygen.	
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.	

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data**Kerosene (Petroleum):**

ORAL (LD50): Acute: 2835 mg/kg [Rabbit]. >5000 mg/kg [Rat].
 DERMAL (LD50): Acute: 2000 mg/kg [Rabbit].
 INHALATION (LC50): Acute: >5000 mg/m³ 4 hour(s) [Rat].

Disulfides, Dialkyl and Di-Ph, Naphtha Sweetening:

ORAL (LD50): Acute: 1,590 mg/kg (Female Rat).
 DERMAL (LD50): Acute: 1800 mg/kg (Rabbit).
 INHALATION (LC50): Acute: > 4,840 mg/L (4 Hours) (Rat).

High levels of dimethyl disulfide, a component of disulfides, di-alkyl and di-phenyl, naphtha sweetening, (Disulfide Oil), may cause hemolytic anemia with potential for development of kidney failure from red blood cell breakdown products excreted in the urine. In experimental animals, dimethyl disulfide overexposures produced hepatic encephalopathy with coma and convulsions. Rats exposed to concentrations of 7 to 26mg/L for 30 to 25 minutes had pulmonary irritation with lung blood vessel damage and convulsions. But, at 805 ppm of dimethyl disulfide for 4 hours, rats had no mortality and only slight liver and spleen damage. Inhalation of 2 ppm for 3 months caused microscopic liver damage. In chickens and other domestic fowl, hemolytic Heinz body anemia was produced by oral administration.

Middle distillates, petroleum:

The products represented by this MSDS contain a mixture of petroleum hydrocarbons commonly referred to as "middle distillates." Laboratory data have associated some middle distillates with skin cancer when the material is applied repeatedly over the lifetime of the test animal. Middle distillates similar to the products represented by this MSDS have been associated with liver and kidney damage in subchronic (90-day) inhalation studies of male rats. The relevance of these findings to human health is unclear.

Naphthalene:

ORAL (LD50): Acute: 1800 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig].
 DERMAL (LD50): Acute: 969 mg/kg [Mouse].
 INHALATION (LC50): Acute: >340 mg/m³ 1 hour(s) [Rat].

Naphthalene is a potential irritant to eyes, skin and lungs. Ingestion of naphthalene has been associated with severe red blood cell and liver damage leading to death. Following prolonged or repeated exposures, naphthalene has been shown to cause cataracts, optical neuritis, hemolytic and aplastic anemia, jaundice and possibly neurotoxicity. In animal studies, naphthalene caused fetal effects and decreased spleen weights in pregnant female mice. In an NTP sponsored study, naphthalene produced a dose related increase in tumors at the 30 and 60 ppm exposure level in both male and female rats. Higher incidences of respiratory epithelial adenomas, olfactory epithelial neuroblastomas and non-neoplastic lesions of the nose were observed as compared to controls. Cytogenic studies with Chinese hamster ovary cells have demonstrated sister chromatid exchanges and chromosomal aberrations. The relevance of these studies to human health is unclear.

Trimethylbenzenes, all isomers:

The TClO for humans is 10 ppm, with somnolence and respiratory tract irritation noted. In inhalation

Kerosene with DSO

studies with rats, four of ten animals died after exposures of 2400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. Mesitylene (1, 3, 5 Trimethylbenzene) inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours.

Biphenyl (Diphenyl):

INHALATION, TCl₀, Acute: 4,400 ug/m³ for 4 hours [Human] - Flaccid paralysis of peripheral nerves without anesthesia and nausea or vomiting.

ORAL, LD₅₀, Acute: >2,600 mg/kg [Cat screening level].

ORAL, LD₅₀, Acute: 2,400 mg/kg [Rat and Rabbit].

ORAL, LD₅₀, Acute: 1,900 mg/kg [Mouse] - Somnolence, hypermotility and diarrhea.

DERMAL, LD₅₀, Acute: >5,010 mg/kg [Rabbit screening level].

Ethylbenzene:

ORAL (LD₅₀): Acute: 3,500 mg/kg [Rat].

DERMAL (LD₅₀): Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD₅₀): Acute: 2,624 mg/kg [Rat].

NTP completed a 2-year inhalation bioassay of ethylbenzene in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	Ecotoxicity data are not available for this product. Based on data from similar products, this material is toxic to aquatic organisms.
Environmental Fate	<p>If spilled, this material will normally evaporate. Hydrocarbon components may contribute to atmospheric smog. If released to the subsoils, petroleum middle distillate fuels will strongly adsorb to soils. Groundwater should be considered as an exposure pathway. Liquid and vapor can migrate through the subsurface and preferential pathways (such as utility line backfill) to downgradient receptors.</p> <p>Middle distillates are potentially toxic to freshwater and saltwater ecosystems. Distillate fuels will normally float on water. In stagnant or slow-flowing waterways, a hydrocarbon layer can cover a large surface area. As a result, this oil layer can limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway can cause a fish kill or create an anaerobic environment. Also, this coating action can also kill plankton, algae, and water birds.</p>

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Kerosene with DSO

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Potential treatment and disposal methods include land farming and incineration. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status	A U.S. Department of Transportation (DOT) regulated material.		
Proper Shipping Name	Not determined.		
Hazard Class	Not determined.	Packing Group(s)	Not determined.
		UN/NA ID	Not determined.
Reportable Quantity	A Reportable Quantity (RQ) has not been established for this material.		
Placards		Emergency Response Guide No.	Not determined.
		HAZMAT STCC No.	Not determined.
		MARPOL III Status	Not determined.
	Not Available (No disponible)		

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Naphthalene [CAS No.: 91-20-3] Concentration: 0 - 3% Ethylbenzene [CAS No.: 100-41-4] Concentration: 0 - 1%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Naphthalene [CAS No.: 91-20-3] RQ = 100 lbs. (45.36 kg) Concentration: 0 - 2% Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: 0 - 1% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 0 - 1%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

Kerosene with DSO

California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Naphthalene: 0 - 3%
New Jersey Right-to-Know Label	Kerosene
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.1
Revision Date 2/28/2003
Print Date Printed on 2/28/2003.

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists AIHA: American Industrial Hygiene Association
IARC: International Agency for Research on Cancer NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health OSHA: Occupational Safety and Health Administration
NPCA: National Paint and Coating Manufacturers Association HMIS: Hazardous Materials Information System
NFPA: National Fire Protection Association EPA: US Environmental Protection Agency

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***** END OF MSDS *****



Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS0992
Revision Date 2/28/2003

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.

Color Transparent, colorless to slightly yellow **Odor** Pungent, Disagreeable odor similar to onions.

DANGER:
Extremely flammable liquid; vapor may cause flash fire or explosion. Vapor may travel considerable distance to source of ignition and flash back.
High concentrations of vapor can reduce oxygen available for breathing and cause suffocation.
Harmful or fatal if swallowed - Can enter lungs and cause damage.
May be harmful if inhaled or absorbed through the skin.
Mist or vapor may irritate the eyes, mucous membranes and respiratory tract.
Liquid contact may cause eye or skin irritation.
Overexposures may cause central nervous system (CNS) depression and target organ effects.
Spills may create a slipping hazard.

Contains Benzene - Cancer Hazard. Can cause leukemia and other blood disorders.

Contains Disulfide Oil. Vapors have a strong offensive odor which may cause headaches, nausea, and vomiting.

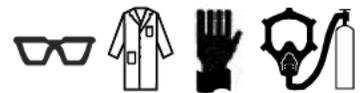
Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	2
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1: IDENTIFICATION

Trade Name	Heavy Hydrodesulfurized Naphtha (C7-C-12 Hydrocarbons)	Technical Contact	(800) 525-4692
Product Number	Not available.	Medical Emergency	(800) 313-7645
CAS Number	64742-82-1	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Heavy Aromatic Naphtha		
Synonyms	Not Applicable.		

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

SECTION 2: COMPOSITION

This product can be described as 100% of any of the following chemical substances and associated CAS numbers:

Heavy Hydrodesulfurized Naphtha (Petroleum) [CAS No.: 64742-82-1]

This product contains the following chemical components:

Component Name(s)	CAS Registry No.	Concentration (%)
1) Disulfides, Dialkyl and Di-Ph, Naphtha Sweetening	68955-96-4	0.2-1
2) Benzene	71-43-2	0-0.2
3) n-Hexane	110-54-3	0-1.6
4) Hexane, other isomers	Mixture	0.2-1
5) C7 Naphthenes	Mixture	7-9
6) Toluene	108-88-3	3-4.5
7) Heptane, all isomers	Mixture	8.8-13
8) Ethylbenzene	100-41-4	1.4-2
9) Xylene, all isomers	1330-20-7	6-8
10) Octanes, all isomers	Mixture	13-20
11) C8 Naphthenes	Mixture	5-11
12) C9 Aromatic Hydrocarbons	Mixture	2.5-7.5
13) Nonane, all isomers	Mixture	10-17
14) C9 Naphthenes	Mixture	3.8-8.1
15) C10+ Aromatic Hydrocarbons	Mixture	1.2-6.2
16) C9+ Saturates	Mixture	11-15
17) Total Olefins	Mixture	0-1.2

SECTION 3: HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations of vapor may cause respiratory irritation, euphoria, excitation or giddiness, headache, nausea, vomiting, abdominal pain, loss of appetite, fatigue, muscular weakness, staggering gait, and central nervous system (CNS) depression. CNS effects include dizziness, drowsiness, disorientation, vertigo, memory loss, visual disturbances, difficulty with breathing, convulsions, unconsciousness, paralysis, coma, and even death, depending upon the exposure duration. Vapors can reduce the oxygen content in air. Sudden death from cardiac arrest (heart attack) may result from exposure to 5,000 ppm for only 5 minutes. Oxygen deprivation is possible if working in confined spaces.
Eye Contact	No irritation to minimal eye irritation is expected upon short-term exposure. This is based upon animal test results for similar materials.
Skin Contact	Tests on similar materials suggest that moderate skin irritation, inflammation, and blistering is expected to occur upon short-term contact. Certain components of this material may be absorbed through the skin. If the skin is damaged, absorption increases.
Ingestion	If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggering gait, drowsiness, loss of consciousness and delirium, as well as additional central nervous system (CNS) effects (see "Inhalation" above).

Due to its light viscosity, there is a danger of aspiration into the lungs during swallowing and subsequent vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse and pallor followed by flushing. Also, progressive CNS depression, respiratory insufficiency and ventricular fibrillation may result in death.

Chronic Health Effects Summary	Prolonged and/or repeated contact may cause moderate to severe skin irritation and inflammation. Symptoms include defatting, redness, dryness, blistering, lesions, and/or scaly dermatitis. Chronic effects of ingestion and subsequent aspiration into the lungs may cause pneumatocele (lung cavity) formation and chronic lung dysfunction. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been common results for gasoline and naphtha abusers.
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Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

- Conditions Aggravated by Exposure** Personnel with pre-existing central nervous system (CNS) disease, psychological conditions, skin disorders, impaired cardiovascular, liver, or kidney function, or chronic respiratory diseases should avoid exposure.
- Target Organs** Contains material which may cause damage to the following organs: lungs, liver, mucous membranes, skin, eyes.
- Carcinogenic Potential** **CARCINOGENIC EFFECTS:** Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Benzene]. Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input checked="" type="checkbox"/>	Toxic	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Sensitizer	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input checked="" type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

SECTION 4: FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

- Inhalation** Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
- Eye Contact** Check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
- Skin Contact** Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.
- Ingestion** Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.
- Notes to Physician** Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Vigorous anti-inflammatory or steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Accordingly, induction of emesis is not recommended. Consider administration of an aqueous slurry of activated charcoal followed by a cathartic such as magnesium citrate or sorbitol. Also, treatment may involve careful gastric lavage if performed soon after ingestion or in patients who are comatose or at risk of convulsing. Protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position. Obtain chest X-ray and liver function tests. Monitor for cardiac function, respiratory distress and arterial blood gases in severe exposure cases.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). If used, monitor heart action closely. Consider use of other drugs with less arrhythmogenic potential.

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

SECTION 5: FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IB flammable liquid.		
Flash Point Method	CLOSED CUP: -6°C (21°F).		
Lower Flammable Limit	AP 0.9 %	Upper Flammable Limit	AP 7.6 %
Autoignition Temperature	232°C (449.6°F)		
Hazardous Combustion Products	Combustion gases may contain carbon monoxide, carbon dioxide, and irritating or acrid combustion products.		
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid enter sewers or waterways.		

SECTION 6: ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Dimethyl Disulfide, a component of this product, has a strong, offensive odor. If this material is released into a work area, evacuate the area immediately. Isolate hazard area. Keep unnecessary and unprotected personnel from entering.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

SECTION 7: HANDLING AND STORAGE

Handling

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles. Keep away from all ignition sources! Ground all equipment containing this material. Containers should be able to withstand pressures expected from warming and cooling in storage. This combustible liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed in accordance with applicable requirements of the NFPA National Electrical Code (NEC).

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. Suitable eye wash water should be readily available.

Hand Protection

Avoid skin contact. Use gloves (e.g., disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.

Body Protection

Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discarded contaminated leather goods.

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

Respiratory Protection For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
1) Benzene	ACGIH (United States). Skin TWA: 0.5 ppm STEL: 2.5 ppm OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm STEL: 5 ppm
2) n-Hexane	ACGIH (United States). Skin TWA: 50 ppm OSHA (United States). TWA: 500 ppm
3) Hexane, other isomers	ACGIH (United States). TWA: 500 ppm STEL: 1000 ppm
4) C7 Naphthenes	ACGIH TLV (United States). TWA: 400 ppm Form: (Methylcyclohexane)
5) Toluene	ACGIH (United States). Skin TWA: 50 ppm OSHA (United States). TWA: 200 ppm CEIL: 300 ppm PEAK: 500 ppm
6) Heptane, all isomers	ACGIH (United States). TWA: 400 ppm STEL: 500 ppm OSHA (United States). TWA: 500 ppm
7) Ethylbenzene	ACGIH (United States). TWA: 100 ppm STEL: 125 ppm OSHA (United States). TWA: 100 ppm
8) Xylene, all isomers	ACGIH (United States). TWA: 100 ppm STEL: 150 ppm OSHA (United States). TWA: 100 ppm
9) Octanes, all isomers	ACGIH (United States). TWA: 300 ppm OSHA (United States). TWA: 500 ppm
10) C9 Aromatic Hydrocarbons	ACGIH TLV (United States). TWA: 25 ppm Form: (Trimethylbenzene)
11) Nonane, all isomers	ACGIH (United States). TWA: 200 ppm

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color Transparent, colorless to slightly yellow	Odor	Pungent, Disagreeable odor similar to onions.
Specific Gravity	0.76 (Water = 1)	pH Not Applicable.	Vapor Density	3.75 (Air = 1)
Boiling Range	60° C (140° F) to 199° C (391° F)		Melting/Freezing Point	Not available.
Vapor Pressure	4.1 kPa (31 mmHg) (at 20°C)		Viscosity (cSt @ 40°C)	Not available
Solubility in Water	Very slightly soluble in cold water.		Volatile Characteristics	760 g/l VOC (W/V)
Additional Properties	Alkane, Isoparaffin and Cycloalkane Hydrocarbons content = 11 to 55 Wt. %[ASTM D-1319]; C7-C12 Aromatic Hydrocarbon Content = 44 to 88 Wt. %[ASTM D-1319]; C7-C12 Olefinic Hydrocarbon Content = <1 Wt. % [ASTM D-1319]; Average Density at 60° F = 6.994 lbs./gallon [ASTM D-2161]; Dry Point Temperature = AP 437° F (225° C) [ASTM D-86]; Octane Rating = AP 92 [ASTM D-2885]; Sulfur Content = AP 0.01 Wt.% [ASTM D-2622 or D-1266]; Evaporation Rate = 0.2 to 1.7 when n-Butyl acetate = 1.0; Heat Value = 18,000 to 18,500 Btu			

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, strong acids, and strong oxidizing conditions.		
Materials Incompatibility	Strong acids, alkalis, and oxidizers such as liquid chlorine, hydrogen peroxide, and oxygen.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11: TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Disulfides, Dialkyl and Di-Ph, Naphtha Sweetening:

ORAL (LD₅₀): Acute: 1,590 mg/kg (Female Rat).
 DERMAL (LD₅₀): Acute: 1800 mg/kg (Rabbit).
 INHALATION (LC₅₀): Acute: > 4,840 mg/L (4 Hours) (Rat).

High levels of dimethyl disulfide, a component of disulfides, di-alkyl and di-phenyl, naphtha sweetening, (Disulfide Oil), may cause hemolytic anemia with potential for development of kidney failure from red blood cell breakdown products excreted in the urine. In experimental animals, dimethyl disulfide overexposures produced hepatic encephalopathy with coma and convulsions. Rats exposed to concentrations of 7 to 26mg/L for 30 to 25 minutes had pulmonary irritation with lung blood vessel damage and convulsions. But, at 805 ppm of dimethyl disulfide for 4 hours, rats had no mortality and only slight liver and spleen damage. Inhalation of 2 ppm for 3 months caused microscopic liver damage. In chickens and other domestic fowl, hemolytic Heinz body anemia was produced by oral administration.

Benzene:

ORAL (LD₅₀): Acute: 930 mg/kg [Rat] - Tremors and convulsions.
 ORAL (LD₅₀): Acute: 4,700 mg/kg [Mouse].
 GAS (LC₅₀): Acute: 10,000 ppm for 7 hours [Rat].
 GAS (LC₅₀): Acute: 9,980 ppm for 8 hr. [Mouse] - General anesthesia, muscle weakness, and

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

dyspnea.

Prolonged and repeated exposure to high concentrations of benzene is associated with injury to blood forming organs and anemia. It is linked to the development of acute myelogenous leukemia (AML) in humans. Studies of workers exposed to high levels of benzene have identified humoral and cellular immunity impairment and a decrease in levels of circulating leukocytes. NTP, IARC and OSHA list benzene as carcinogenic to humans. Consumption of alcohol may increase the blood system changes related to benzene exposure. Animal studies have shown testicular effects and alterations in reproductive cycles, but teratogenic effects have not been reported even at maternally toxic doses. Also, animal studies show some evidence of fetotoxic and developmental effects.

Toluene:

Deliberate long-term inhalation of toluene at high concentrations (e.g., glue sniffing) has been associated with liver effects, kidney damage, CNS depression, brain damage and cardiac sensitization. In addition, intentional abuse behavior increases the risk for reproductive effects including pre-term delivery, prenatal death and growth retardation. Also, case studies of persons abusing toluene have revealed isolated incidences of birth defects. Long-term inhalation studies with toluene produced kidney damage, enlargement of the liver and thymus, heart palpitations, brain damage, general weakness and impaired reaction time in laboratory animals. Case studies have reported hearing damage in humans exposed elevated concentrations of toluene and other mixed solvents.

Heptane, all isomers:

n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

Ethylbenzene:

ORAL (LD₅₀): Acute: 3,500 mg/kg [Rat].

DERMAL (LD₅₀): Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD₅₀): Acute: 2,624 mg/kg [Rat].

NTP completed a 2-year inhalation bioassay of ethylbenzene in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. However, based upon this data, the IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

Xylene, all isomers:

ORAL (LD50): Acute: 4,300 mg/kg [Rat].

GAS (LC50): Acute: 4,550 ppm for 4 hours [Rat].

DERMAL (LD50): Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Also, ototoxicity has been associated with chronic overexposure to xylene. An inhalation study with laboratory rats indicated an association between elevated exposures to mixed xylenes and hearing loss. Animal studies have associated embryo and fetotoxicity with maternally toxic dose exposures of mixed xylene isomers and ethylbenzene. Lung inflammation and liver damage were identified as health effects in chronic studies using guinea pigs. The significance of these animal study results to humans is not known.

C9 Aromatic Hydrocarbons:

C9 aromatic hydrocarbons can cause eye, skin and respiratory irritation. No significant mutagenicity, chromosomal aberrations or neurological effects were observed in evaluations conducted pursuant to a TSCA test rule. A NOEL of 100 ppm was established from developmental toxicity and 3-generation reproductive toxicity studies required under the test rule. Parental toxicity (reduced body weight and food consumption) was present at all exposure levels.

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity	<p>Ecological effects testing has not been conducted on this material. If spilled, this naphtha, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Volatile aromatic hydrocarbon components may be released and possibly contribute to the creation of atmospheric smog.</p> <p>Using Rainbow Trout (<i>Oncorhynchus mykiss</i>) and Dungeness Crab (<i>Cancer magister</i>), similar naphthas showed a 96-hour TLm (Median Toxic Limit) from 5 ppm to 30 ppm in ambient saltwater. Also, 24-hour and 96-hour TLms produced results from 60 ppm to 200 ppm when using Bluegill Sunfish (<i>Lepomis macrochirus</i>), Goldfish (<i>Carassius auratus</i>), Guppy (<i>Lebistes reticulatus</i>) and juvenile American Shad (<i>Squalius cephalus</i>) in fresh water. Also, 24-hour and 96-hour LC50s for toluene produced results from 25 ppm to 60 ppm when using Bluegill Sunfish (<i>Lepomis macrochirus</i>), Goldfish (<i>Carassius auratus</i>), and Guppy (<i>Lebistes reticulatus</i>) in fresh water. Using Water Fleas (<i>Daphnia magna</i>), toluene showed 24-hour TLms of from 100 ppm to 200 ppm. Based upon actual spill incident investigations, similar naphthas have been shown to bioaccumulate in tissues of various fish from a 1 ppm to 10 ppm levels.</p>
Environmental Fate	<p>This mixture contains components that are potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components evaporating rapidly. In stagnant or slow-flowing waterways, a hydrocarbon layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds.</p>

SECTION 13: DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14: TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Petroleum distillates, n.o.s. (Octanes, Nonanes)		
Hazard Class	3	Packing Group(s)	II
		UN/NA ID	UN1268
Reportable Quantity	100 lbs. (45.36 kg)		
Placards			

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

Emergency Response Guide No.	128
HAZMAT STCC No.	491026
MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

SECTION 15: REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Benzene [CAS No.: 71-43-2] Concentration: 0.1% Toluene [CAS No.: 108-88-3] Concentration: 3.8% Ethylbenzene [CAS No.: 100-41-4] Concentration: 1.7% Xylene, all isomers [CAS No.: 1330-20-7] Concentration: 7%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: 0.1% n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: 0.8% Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: 3.8% Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: 1.7% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 7%
CWA	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Benzene: 0.1% Toluene: 3.75%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

Heavy Hydrodesulfurized Naphtha (C7-C12 Hydrocarbons) with DSO

SECTION 16: OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.00
 Revision Date 2/28/2003
 Print Date Printed on 2/28/2003.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists	AIHA: American Industrial Hygiene Association					
IARC: International Agency for Research on Cancer	NTP: National Toxicology Program					
NIOSH: National Institute of Occupational Safety and Health	OSHA: Occupational Safety and Health Administration					
NPCA: National Paint and Coating Manufacturers Association	HMIS: Hazardous Materials Information System					
NFPA: National Fire Protection Association	EPA: US Environmental Protection Agency					

DISCLAIMER OF LIABILITY

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THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

RS1000 151 Coker
 HFE# 200 ADU unit
 533 crude BRU/merox
 536 crude BTU
 537 crude HDS-2
 732 FCCU old HDS/53
 733/735 mag DRU
 736 COKER SRU



Refinery Heater Flue Gas

Material Safety Data Sheet

LYONDELL-CITGO Refining LP
 12000 Lawndale Avenue
 P.O. Box 2451
 Houston, TX 77252-2451

MSDS No. RS1000
Revision Date 5/8/2003

Hazard Rankings		
	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	0	0
Reactivity	0	0

* = Chronic Health Hazard

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IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview			
Physical State	Gas.		
Color	Colorless.	Odor	Odorless.
WARNING!			
Hot gas contact will cause burns and tissue damage.			
May be harmful or fatal if inhaled.			
Gas reduces oxygen available for breathing and may cause central nervous system (CNS) depression or suffocation.			
May contain toxic Carbon Monoxide (CO).			

Protective Equipment
Minimum Recommended See Section 8 for Details This recommendation reflects minimum PPE when product is at elevated temperatures

SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Refinery Heater Flue Gas	Technical Contact	(800) 525-4692
Product Number	RS1000	Medical Emergency	(800) 313-7645
CAS Number	Mixture---See Section 2.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Refinery Waste Gas		
Synonyms	Heater Flue Gas; Flue Gas		

SECTION 2. COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
Nitrogen	7727-37-9	70-75
Carbon dioxide	124-38-9	7-9
Water	7732-18-5	16-18
Oxygen	7782-44-7	3-6

Refinery Heater Flue Gas

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Inhalation. Skin Contact. Eye Contact.

Signs and Symptoms of Acute Exposure

Inhalation **Nitrogen**, the major component of this material, is a "simple asphyxiant" (see Section 8). Its vapors can displace the amount of oxygen in air available to breathe below that necessary to sustain life, especially if working in confined spaces. Symptoms of oxygen deficiency may include increased breathing rate; accelerated heart beat; impaired attention, thinking and coordination.

Carbon monoxide is toxic to humans and has been determined to be "immediately hazardous to life and health (IDLH)" at a concentration of 1,200 ppm in air. (See Section 11.)

Eye Contact Upon direct contact, hot gas may cause severe thermal burns.

Skin Contact Skin contact with hot gas may result in severe thermal burns.

Ingestion Ingestion is not an applicable route of exposure for gases.

Chronic Health Effects Summary Chronic **carbon monoxide (CO)** inhalation exposure may cause mild effects on the heart, blood, nervous system, and reproductive system. Also, the human fetus may be highly susceptible to the neurological effects of carbon monoxide because the generated levels of bound carboxyhemoglobin (COHb) are often the same as the mother. Fetal oxygen demand is higher than that of the mother and its blood COHb releases CO more slowly. COHb levels of 10% or higher can cause brain damage in the fetus, with greater risk during late pregnancy. (See Section 11.)

Conditions Aggravated by Exposure Personnel with pre-existing chronic respiratory or central nervous system (CNS) diseases or skin, blood, and/or cardiovascular conditions should avoid exposure. Persons who smoke 2 or more packs of cigarettes per day or who are compromised in their ability to use oxygen, such as asthmatics and those with heart disease, reduced pulmonary function, or anemia, may be more sensitive to excess concentrations of "simple asphyxiants" and **carbon monoxide**.

Target Organs This material causes damage to the following organs: mucous membranes, skin, eyes, central nervous system, brain, and possibly, the heart, blood and reproductive system.

Carcinogenic Potential This material does not contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC, or NTP.

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input checked="" type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input type="checkbox"/>	Carcinogenic	<input type="checkbox"/>	Compressed Gas	<input checked="" type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Refinery Heater Flue Gas

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing (CPR), as necessary. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.
Eye Contact	Check for and remove contact lenses. If tissue is frozen, immediately seek medical attention. If tissue is not frozen, immediately and thoroughly flush the eye(s) gently with large amounts of clean, low-pressure warm water (105° to 115°F) for at least 15 minutes, occasionally lifting the upper and lower eyelids to ensure complete irrigation of the eye and eyelid tissue. Do not use hot water! Do not use eye ointment. If pain, redness, swelling, or tearing persist, obtain medical attention as soon as possible.
Skin Contact	If burned by hot gas, cool affected skin by quenching with cool water. Seek medical attention immediately. If frozen, the affected tissue area should be placed in a warm water bath with temperatures at or below 40°C (104°F). DO NOT use dry heat or hot water! Rewarming should continue until natural skin tones return to the affected area. If skin surface is damaged or if pain or irritation persists, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water.
Ingestion	Due to the gaseous nature of this material, ingestion is not a likely route of entry.
Notes to Physician	Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. Inhalation overexposure can produce other toxic effects. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, or pneumonitis. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required. Monitor arterial blood gases and chest x-ray in cases with significant exposure.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Non-flammable Gas Mixture.		
Flash Point	Not applicable		
Lower Flammable Limit	AP 12.5% for Carbon Monoxide.	Upper Flammable Limit	AP 74% for Carbon Monoxide.
Autoignition Temperature	609°C (1128°F) for Carbon Monoxide.		
Hazardous Combustion Products	Not applicable		
Special Properties	If released, immediately evacuate personnel to a safe upwind area. This mixture may be lighter than air and rises rapidly collecting in the upper portions of confined spaces. The heavier components of this mixture will stay near the ground. Exposed to an ignition source, they could ignite with explosive force. Keep away from all ignition sources!		
Extinguishing Media			

Refinery Heater Flue Gas

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS THE GAS FLOW CAN BE STOPPED! Control the fire until the source gas supply can be shut off and then allow the fire to burn itself out. Cool tanks, containers, other structures, equipment, and surfaces exposed to the fire with water fog or spray in order to prevent pressure build-up, autoignition, or explosion. Use water, dry chemical, carbon dioxide (CO₂), and/or inert gas (nitrogen) to extinguish adjacent burning materials.

Protection of Fire Fighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion/decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Non-flammable Compressed Gas! Evacuate all non-essential personnel to an area upwind. Safely stop the source gas flow using non-sparking tools. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres.

SECTION 7. HANDLING AND STORAGE

Handling

WARNING! May contain a Poisonous Gas! Do NOT breathe vapor; it might contain carbon monoxide (CO) and/or a simple asphyxiant. Odor is not an adequate warning of potentially hazardous air concentrations. Use only with proper personal protective equipment including supplied breathing air. Releases of this material can cause atmospheres to become oxygen deficient and/or create a fire or explosion hazard. Do not enter such areas/confined spaces without adequate safety procedures including appropriate monitoring system with alarms for oxygen deficiency, CO concentrations, and flammability.

When performing repairs or maintenance on contaminated equipment, keep unnecessary persons away from the hazard area. Eliminate heat and other ignition sources. Use non-sparking and explosion-proof equipment. Provide ventilation to maintain exposures below the applicable workplace exposure limits shown in Section 8. Do not allow gas to contact eyes, skin or other tissues. Wear protective work clothing and chemical splash goggles and face shield or supplied air when contact with escaping compressed gas is anticipated.

Storage

Do not store this material near heat. Segregate from oxidizers and combustible materials by a distance of at least 20 feet. Do not store this product in unlabeled containers. Keep containers tightly closed.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Local exhaust and general room ventilation may both be essential in work areas to prevent accumulation of explosive gas/air mixtures. If mechanical ventilation is used, all equipment must comply with the National Electrical Code (NEC) Standards. If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved supplied air respiratory protection. Ensure that an emergency eye wash station and safety shower are near the work-station location.

Refinery Heater Flue Gas

Personal Protective Equipment Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

This recommendation reflects minimum PPE when product is at elevated temperatures.



- Eye Protection** Use full-face respirator and face shield (ANSI Z87.1 or approved equivalent) when handling this gas mixture.
- Hand Protection** Use insulated, chemical-resistant gloves or leather gloves over impervious, chemically-resistant gloves to protect hands from potential contact with hot or cold vapors.
- Body Protection** Prevent potential skin contact with hot or cold vapors. Use insulated and chemical-resistant clothing (apron, slicker suit, coveralls, boots, etc.). Fire-retardant garments (e.g. Nomex®) should be worn while working with flammable gases.
- Respiratory Protection** Odor is not an adequate warning for potentially hazardous air concentrations! Use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), especially when entering a confined space or area where the oxygen concentration may be reduced because of an accumulation of gas vapors. Otherwise, use a NIOSH-approved supplied air respirator. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent (e.g. ANSI Z88.2)
- General Comments** For an explanation about the occupational exposure limits shown below, refer to the definition of "**Simple Asphyxiant**" presented in the American Conference of Governmental Industrial Hygienists (ACGIH) most current **Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents** handbook. Releases of these gases may cause atmospheres, some oxygen-deficient (< 19.5 Vol.% in air), which may have flammable/explosive potential. **DO NOT ENTER** such areas/confined spaces without special safety procedures including appropriate monitoring for oxygen deficiency and flammability.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Nitrogen	Simple asphyxiant.
Carbon dioxide	TWA: 5,000 (ppm) from ACGIH (TLV) 30,000 (ppm) from ACGIH (STEL) TWA: 5,000 (ppm) from OSHA (PEL) 30,000 (ppm) from OSHA (STEL) [Proposed]
Carbon monoxide	TWA: 25 (ppm) from ACGIH (TLV) TWA: 50 (ppm) from OSHA (PEL) TWA: 35 CEIL. 200 (ppm) from OSHA [Proposed]

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Gas.	Color	Colorless.	Odor	Odorless.
Specific Gravity	0.81 to 0.83 (Water = 1)	pH	Water contact might produce an acidic solution.	Vapor Density	0.97 to 1.5 (Air = 1)
Boiling Range	-195° to -78°C (-320° to -109°F) (ASTM-2887)	Melting/Freezing Point			-218° to -206°C (-361° to -340°F)

Refinery Heater Flue Gas

Vapor Pressure	50 to 100 psia at 100°F (38°C)	Volatility	If open to the atmosphere, it will disperse rapidly or might form a vapor cloud depending upon its temperature and the terrain.
Solubility in Water	Negligible to slightly soluble in cold water depending upon its temperature.	Viscosity (cSt @ 40°C)	Not applicable.
Additional Properties	Not applicable.		

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from extreme heat, sparks, open flame and strongly reducing conditions.		
Materials Incompatibility	Strong acids, alkalies, halogens, and organic materials.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Carbon monoxide (CO) is extremely toxic with permanent effects from acute exposure. CO is toxic because it binds to hemoglobin in the blood, preventing oxygen binding, reducing blood transport capacity, and thus cellular respiration. Breathing CO at 5 to 30 ppm in air, or smoking one pack of cigarettes per day, increases the blood carboxyhemoglobin (COHb) level in an adult to between 1 and 5%. Exposure to ambient CO levels of 30 to 60 ppm in air, or smoking up to 3 packs of cigarettes per day, increases blood COHb to a range of 5 to 9%. At this COHb level, persons with coronary artery disease can develop chest pain upon moderate exertion. Binding of CO to hemoglobin is slowly reversible, with a half-life of approximately 5 to 7 hours while breathing room air.

Acute CO poisoning occurs frequently and is the most common cause of lethal poisonings in the U.S.A. and France (17.5 deaths per 100,000 population from fires, automobile exhaust, defective heaters and stoves, and improper use of charcoal briquettes). Also, almost every known neurological disorder has been associated with CO poisoning, including deafness, blindness, and Parkinsonism. Structural damage of the brain can be seen on the CAT scans of persons who survived high-level acute CO exposures. Neurological deterioration may be delayed following recovery. Acute CO exposure also affects the heart, producing damage to the myocardium, because it requires a high level of oxygenation.

Whether or not there is a chronic CO poisoning distinct from the acute effects is controversial. However, chronic CO exposure can aggravate angina pectoris in persons with coronary artery disease.

Refinery Heater Flue Gas

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	Ecological effects testing has not been conducted on this gas mixture. Releases are expected to cause only localized non-persistent environmental damage; however, at ambient or higher temperatures and pressure, the carbon monoxide component of this material will readily vaporize and may contribute to generation of atmospheric smog.
Environmental Fate	Carbon monoxide residence times in the atmosphere range from about one day to more than 40 days, depending upon the season, latitude, and presence of other air pollutants. Reduced temperatures increase the residence time.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

This material is probably not a RCRA Hazardous Waste on disposal. However, allow fugitive concentrations to dissipate to well below the lower explosive limit shown in Section 5 before proceeding with its clean-up. This material may be disposed of by controlled high-temperature burning in a properly designed incinerator, if possible and permissible. Venting of this gas to the atmosphere should be avoided. Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and local regulations. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues. Defective, empty, or partially used portable containers should be returned to the supplier with appropriate tags.

SECTION 14. TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status	A U.S. Department of Transportation (DOT) regulated material.		
Proper Shipping Name	Nitrogen and rare gases mixture		
Hazard Class	2.2 (Non-flammable gas)	Packing Group(s)	Not applicable.
		UN/NA Number	UN1981
Reportable Quantity	A Reportable Quantity (RQ) has not been established for this material.		
Placard(s)		Emergency Response Guide No.	121
		HAZMAT STCC No.	49 045 69
		MARPOL III Status	Not a DOT "Marine Pollutant" per 49 CFR 171.8.

Refinery Heater Flue Gas

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. Chemical substances present in this material and are not subject to this statute.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Sudden Release of Pressure, and Acute (Immediate) and Chronic (Delayed) Health Hazards.
SARA 313 Toxic Chemical Notification and Release Reporting	This material does not contain any components in concentrations which are at or above de minimis levels which are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. Chemical substances present in this material are not subject to this statute.
Clean Water Act (CWA)	This material is NOT classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA).
California Proposition 65	This material does not contain any chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm, and therefore, it is not subject to requirements of California Health & Safety Code Section 25249.5.
New Jersey Right-to-Know Label	For New Jersey labeling, refer to the components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 5.0
Revision Date 5/8/2003
Print Date Printed on 5/8/2003.

ABBREVIATIONS

AP: Approximately	EQ Equal	> Greater Than	<: Less Than	NA Not Applicable	ND: No Data	NE Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		

Refinery Heater Flue Gas

NFPA: National Fire Protection Association

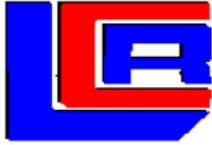
EPA US Environmental Protection Agency

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****



Merox Lift Station Hydrocarbon/Caustic Stream Material Safety Data Sheet

LYONDELL-CITGO Refining LP
12000 Lawndale Avenue
P.O. Box 2451
Houston, TX 77252-2451

MSDS No. RS6806
Revision Date 11/3/2003

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.
Color Brown to black. (Dark.) **Odor** Faint Odor (Hydrogen sulfide odor).

DANGER!

Corrosive. Causes eye and skin burns.
Causes respiratory irritation and can cause damage to respiratory system.
May be harmful or fatal if swallowed.
If swallowed, seek medical attention immediately.

Contains bound Hydrogen Sulfide and Mercaptans. Flammable and poisonous gas may be released if this material comes into contact with acids, heat or agitation.

This material contains ethylbenzene at concentrations at or above 0.1%. Ethylbenzene is considered possibly carcinogenic to humans by IARC.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 3	3
Fire Hazard	1	1
Reactivity	1	1

* = Chronic Health Hazard

Protective Equipment

**Minimum Recommended
See Section 8 for Details**

Minimum PPE reflects the requirements for this material at this facility:

LYONDELL-CITGO Refining
LP Manufacturing Complex



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	Merox Lift Station Hydrocarbon/Caustic Stream	Technical Contact	(800) 525-4692
Product Number	RS6806	Medical Emergency	(800) 313-7645
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300
Product Family	Refinery Intermediate Stream		
Synonyms	None.		

SECTION 2. COMPOSITION (TYPICAL)

Component Name(s)	CAS Registry No.	Concentration (%)
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Merox Lift Station Hydrocarbon/Caustic Stream

Water	7732-18-5	75-89
Sodium Hydroxide	1310-73-2	4.7-18.2
C8 Naphthenes	Mixture	0.33-0.73
C7 Naphthenes	Mixture	0.5-0.7
Xylene, all isomers	1330-20-7	0.4-0.5
C9 Naphthenes	Mixture	0.3-0.5
C9 Aromatic Hydrocarbons	Mixture	0.17-0.5
C10+ Aromatic Hydrocarbons	Mixture	0.1-0.4
Toluene	108-88-3	0.2-0.3
Hexane, other isomers	Mixture	0-0.15
n-Hexane	110-54-3	0-0.1
Ethylbenzene	100-41-4	0.1-0.13
Alkyl mercaptans	74-93-1	0-0.09
Hydrogen Sulfide	7783-06-4	0-0.09
Ethyl mercaptan	75-08-1	0-0.05
Benzene	71-43-2	0-0.013

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing vapors or aerosols from this material can cause irritation of the throat and lungs with cough and difficult breathing.
Eye Contact	Contact can cause burns and permanent injury to eye tissue. Can cause blindness.
Skin Contact	Contact can cause skin burns and permanent skin damage.
Ingestion	Swallowing this material may be harmful or cause death. Harmful effects include burns and permanent damage to the digestive tract, including the mouth, throat, stomach and intestines. Symptoms may include severe abdominal pain and vomiting of blood. Blood loss through damaged tissue can lead to low blood pressure and shock.

Chronic Health Effects Summary Prolonged and/or repeated skin contact may produce severe irritation and inflammation. This material, or a component of this material is a suspect cancer hazard and may cause cancer in humans.
See Toxicological Information (section 11)

Conditions Aggravated by Exposure Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin

Target Organs This material causes damage to the following organs: skin, eye, lens or cornea.

Carcinogenic Potential **CARCINOGENIC EFFECTS:** Classified 2B (Possible for human.) by IARC [Ethylbenzene].

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant	<input type="checkbox"/>	Sensitizer	<input type="checkbox"/>	Combustible	<input type="checkbox"/>	Explosive	<input type="checkbox"/>	Pyrophoric	<input type="checkbox"/>
Toxic	<input type="checkbox"/>	Highly Toxic	<input type="checkbox"/>	Flammable	<input type="checkbox"/>	Oxidizer	<input type="checkbox"/>	Water-reactive	<input type="checkbox"/>
Corrosive	<input checked="" type="checkbox"/>	Carcinogenic	<input checked="" type="checkbox"/>	Compressed Gas	<input type="checkbox"/>	Organic Peroxide	<input type="checkbox"/>	Unstable	<input type="checkbox"/>

Merox Lift Station Hydrocarbon/Caustic Stream

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to **Exposure Controls and Personal Protection in Section 8 of this MSDS.**

Inhalation	Immediately move exposed individual to fresh air. Monitor for respiratory distress. If the individual is not breathing, immediately begin rescue breathing. If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. Persons providing mouth-to-mouth rescue breathing may be placing themselves at risk either from exposure to toxic materials or communicable disease.
Eye Contact	Do not attempt to remove contact lenses. Immediately irrigate eyes with copious amounts of cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.
Skin Contact	Flush thoroughly with cool water under a shower of water for at least 15 minutes while removing contaminated shoes and clothing. Seek medical attention if tissue appears damaged or if pain or irritation persists. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.
Ingestion	Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. Do not attempt to neutralize. Have victim rinse mouth with water then drink two to three large glasses of milk or water. Never give anything by mouth to a person who is not fully conscious. Keep airway clear. Seek medical attention immediately.
Notes to Physician	<p>INHALATION: Treat as corrosive material. Monitor for pharyngeal and pulmonary edema. Onset may be delayed up to 24 hours from exposure. Administer supplemental oxygen with assisted ventilation, as required.</p> <p>SKIN: Treat as corrosive material. Wash contaminated skin thoroughly with water or saline.</p> <p>INGESTION: Due to the potential for esophageal or gastrointestinal tract burns following ingestion, do not induce emesis. Careful gastric lavage may be considered. Immediate dilution with water or milk may be beneficial. Do not treat with sodium bicarbonate or attempt to neutralize as this can cause exothermic gas generation and, in severe cases, cause perforation.</p>

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	Not applicable.		
Flash Point	Not applicable.		
Lower Flammable Limit	Not determined.	Upper Flammable Limit	Not determined.
Autoignition Temperature	Not applicable.		
Hazardous Combustion Products	Material does not support combustion. No hazardous decomposition products are expected.		
Special Properties	This material may react with water and acid solutions. This material is not expected to burn and therefore no special procedures should be necessary.		
Extinguishing Media	Not expected to present a fire or explosion hazard. Use foam, waterspray, dry chemical, or carbon dioxide (CO ₂) as extinguishing agents should this material become involved in a fire.		

Merox Lift Station Hydrocarbon/Caustic Stream

Protection of Fire Fighters

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the **Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.**

Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Do not get water inside containers. Minor leaks or spills can be diluted and neutralized with plenty of water. To avoid the evolution of poisonous hydrogen sulfide gas, this acid must not be allowed to contact sulfide wastes (as in sewers). Absorb or cover the neutralized residue with dry earth, sand, or other non-combustible material and transfer to containers. All clean-up materials should be removed for proper treatment or disposal. Contain large spills to maximize product recovery or disposal. Prevent entry into waterways or sewers. In urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from ecologists to minimize physical habitat damage. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

Do not breathe vapor or mist. Do not get in eyes, on skin or on clothing. Wash thoroughly after handling.

Storage

Store in glass or other approved containers away from chemicals and combustible materials. Store in a cool, dry, secure and well ventilated area away from sunlight. Keep away from heat, sparks and flame. Keep container tightly closed. Storage area should be equipped with an appropriate chemical resistant floor. Drainage facilities should be constructed for containment of small spills.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

No special ventilation is required under normal conditions of use. Where engineering controls are feasible, use adequate local exhaust ventilation wherever mist, spray, or vapor may be generated. Where carbon dioxide or sulfur dioxide may be generated, special ventilation may be required. Ensure that an emergency eye wash station and safety shower are located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

Minimum PPE reflects the requirements for this material at this facility: LYONDELL-CITGO Refining LP Manufacturing Complex



Merox Lift Station Hydrocarbon/Caustic Stream

Eye Protection	Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. When there is a likelihood of misting, splashing, or spraying, chemical-resistant goggles and full-face shield should be worn. Suitable eye wash water should be readily available.
Hand Protection	Avoid skin contact. Disposable neoprene, rubber, or vinyl gloves are required for use. Wash hands and other exposed skin with mild soap and water before eating, drinking, smoking, or using the toilet facilities.
Body Protection	Avoid all skin contact. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, butyl rubber, or neoprene) should be worn. Protective clothing should include long-sleeves, apron, slicker suit, boots and additional facial protection. Use a full-body corrosives suit whenever appropriate. If general contact occurs, IMMEDIATELY get under an emergency shower and remove contaminated clothing. Then take a thorough shower. Contaminated leather goods should be removed immediately and discarded.
Respiratory Protection	For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved acid gas-organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).
General Comments	Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. Do not use gasoline, kerosene, solvents, or harsh abrasive skin cleaners. Use of personal protective equipment and good personal hygiene are essential to controlling exposures to this aqueous solution.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
C9 Aromatic Hydrocarbons	ACGIH TLV (United States). TWA: 25 ppm 8 hour(s). Form: (Trimethylbenzene)
Xylene, all isomers	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 150 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
Ethylbenzene	ACGIH (United States). TWA: 100 ppm 8 hour(s). STEL: 125 ppm 15 minute(s). OSHA (United States). TWA: 100 ppm 8 hour(s).
Toluene	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm PEAK: 500 ppm
n-Hexane	ACGIH (United States). Skin TWA: 50 ppm 8 hour(s). OSHA (United States). TWA: 500 ppm 8 hour(s).
Benzene	ACGIH (United States). Skin TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s). OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL. TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s).

Merox Lift Station Hydrocarbon/Caustic Stream

Ethyl mercaptan	ACGIH (United States). TWA: 0.5 ppm 8 hour(s). CEIL: 10 ppm
Alkyl mercaptans	ACGIH TLV (United States). TWA: 0.5 ppm 8 hour(s). OSHA PEL Z2 (United States). CEIL: 10 ppm
Hydrogen Sulfide	ACGIH TLV (United States). TWA: 10 ppm 8 hour(s). STEL: 15 ppm 15 minute(s). OSHA (United States). CEIL: 20 ppm 8 hour(s). STEL: 50 ppm 15 minute(s). Form: *10 minute peak; once per 8 hour shift
Sodium Hydroxide	ACGIH TLV (United States). CEIL: 2 mg/m ³ OSHA (United States). TWA: 2 mg/m ³ 8 hour(s).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Brown to black. (Dark.)	Odor	Faint Odor (Hydrogen sulfide odor).
Specific Gravity	>1 (Water = 1) (Estimated.)	pH	> 12.5	Vapor Density	> 1
Boiling Range	AP 100° C (AP 212° F)			Melting/Freezing Point	<0°C (32°F)
Vapor Pressure	The highest known value is 2.3 kPa (17.5 mmHg) (at 20°C) (Water).			Volatility	Non-volatile.
Solubility in Water	Easily soluble in cold water. Soluble in methanol.			Viscosity (cSt @ 40°C)	Not determined.
Additional Properties	No additional information.				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	This material is incompatible with acids and oxidizers.		
Materials Incompatibility	May react or be incompatible with acids.		
Hazardous Decomposition Products	This material is expected to be unreactive with most common materials. No hazardous chemical reaction products are expected.		

Merox Lift Station Hydrocarbon/Caustic Stream

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Ethylbenzene:

ORAL (LD50): Acute: 3,500 mg/kg [Rat].

DERMAL (LD50): Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50): Acute: 2,624 mg/kg [Rat].

NTP completed a 2-year inhalation bioassay of ethylbenzene in rodents. The study was conducted in rats and mice at exposure concentrations of 0, 75, 200 and 750 ppm. No significant effects were observed at the 75 and 200 ppm levels. However, compared to chamber controls, the severity of nephropathy was increased in rats at the 750 ppm level; and male rats had higher incidences of renal tubule carcinomas. Step section analyses of the kidneys found a significant increase hyperplasia and renal tubule adenomas in both male and female rats. Also at this 750 ppm level, male mice had a higher incidence of alveolar/bronchiolar adenomas and carcinomas and female mice had increased hepatocellular adenomas and carcinomas when compared to chamber controls. Also, hyperplasia was observed in the thyroid gland of both sexes of mice and in the pituitary gland of female mice. The relevance of these findings to human health is unclear. Based upon this data, IARC has designated ethylbenzene as possibly carcinogenic to humans (Group 2B).

Disulfides, Dialkyl and Di-Ph, Naphtha Sweetening:

ORAL (LD50): Acute: 1,590 mg/kg (Female Rat).

DERMAL (LD50): Acute: 1800 mg/kg (Rabbit).

INHALATION (LC50): Acute: > 4,840 mg/L (4 Hours) (Rat).

High levels of dimethyl disulfide, a component of disulfides, di-alkyl and di-phenyl, naphtha sweetening, (Disulfide Oil), may cause hemolytic anemia with potential for development of kidney failure from red blood cell breakdown products excreted in the urine. In experimental animals, dimethyl disulfide overexposures produced hepatic encephalopathy with coma and convulsions. Rats exposed to concentrations of 7 to 26mg/L for 30 to 25 minutes had pulmonary irritation with lung blood vessel damage and convulsions. But, at 805 ppm of dimethyl disulfide for 4 hours, rats had no mortality and only slight liver and spleen damage. Inhalation of 2 ppm for 3 months caused microscopic liver damage. In chickens and other domestic fowl, hemolytic Heinz body anemia was produced by oral administration.

Sodium Hydroxide:

DERMAL (LD50): Acute: 1350 mg/kg [Rabbit].

A severe eye, skin and respiratory tract irritant. Corrosive to many organic compounds. If ingested, sodium hydroxide can cause severe pain, bloody diarrhea, cardiovascular collapse and death.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity	An environmental fate analysis has not been conducted on this specific product.
Environmental Fate	This product is miscible in water and is expected to readily disperse in marine environments.

Merox Lift Station Hydrocarbon/Caustic Stream

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its corrosivity (D002). In addition, conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

This material has not been evaluated for proper Department of Transportation shipping name and hazard classification. If shipped in commerce, it may be a DOT Hazardous Material. Contact your transportation specialist or call the technical contact on this MSDS for assistance.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Ethylbenzene [CAS No.: 100-41-4] Concentration: 0.1%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: 0.45% Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: 0.007%

Merox Lift Station Hydrocarbon/Caustic Stream

Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Toluene: 0.25% Benzene: 0.0065%
New Jersey Right-to-Know Label	For New Jersey R-T-K labeling requirements, refer to components listed in Section 2.
Additional Regulatory Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 1.00
Revision Date 11/3/2003
Print Date Printed on 11/3/2003.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

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***** END OF MSDS *****

Table 1-1 Regulatory Cross Reference Table

§154.1030	Brief Citation Description	SRPP Section
General response plan contents.		
(a)	The plan must be written in English.	Entire Plan
(b)	A response plan must be divided into sections...	---
(b)(1)	Introduction and plan contents.	§1.0
(b)(2)	Emergency Action Plan (EAP)	EAP
(b)(2)(i)	Notification procedures.	§3.0, EAP
(b)(2)(ii)	Facility's spill mitigation procedures.	§5.0
(b)(2)(iii)	Facility's response activities.	§3.0
(b)(2)(iv)	Fish and wildlife and sensitive environments.	§5.0
(b)(2)(v)	Disposal plan.	§5.0
(b)(3)	Training and Exercises:	---
(b)(3)(i)	Training procedures.	§8.0
(b)(3)(ii)	Exercise procedures.	§8.0
(b)(4)	Plan review and update procedures.	§1.4
(b)(5)	Appendices.	---
(b)(5)(i)	Facility-specific information.	§1.0, Figure 1-7
(b)(5)(ii)	List of contacts.	Table 3-1, Table 3-2
(b)(5)(iii)	Equipment lists and records.	§3.0
(b)(5)(iv)	Communications plan	EAP
(b)(5)(v)	Site-specific safety and health plan.	ERAP
(b)(5)(vi)	List of acronyms and definitions.	Acronyms, Table 1-2
(b)(5)(vii)	A geographic-specific appendix ... mobile facility operates.	---
(c)	... contained in §§154.1035, 154.1040, and 154.1041, as appropriate.	---
(d)	...information required in §§ 154.1035, 154.1040, and 154.1041...	---
(e)	... cross-reference ...	Table 1-1
(f)	... be consistent with the NCP and ACP ...	Entire Plan

Source: CGD 91-036, 61 FR 7917, February 29, 1996

Table 1-1 Regulatory Cross Reference Table

§154.1035	Brief Citation Description	SRPP Section
Specific requirements for facilities that could reasonable be expected to cause significant and substantial harm to the environment.		
(a)	<i>Introduction and plan content.</i>	§1.0
(a)(1)	The facility's name, street address, city, county, state, ZIP code, facility telephone number, and telefacsimile number, if so equipped...	Figure 1-7, ERAP
(a)(2)	The facility's location ...	Figure 1-7, ERAP
(a)(3)	... name, address, and procedures ... owner or operator ... 24-hour basis.	Figure 1-7, ERAP
(a)(4)	A table of contents.	TOC
(a)(5)	... cross index	Table 1-1
(a)(6)	A record of change(s) to record information and plan updates.	Table 1-3
(b)	<i>Emergency Response Action Plan...</i>	ERAP
(b)(1)	Notification procedures.	§3.0
(b)(1)(i)	... a prioritized list identifying the person(s) ... to be notified of a discharge or substantial threat of a discharge of oil ...	§3.0, Table 3-1, Table 3-2
(b)(1)(i)(A)	Facility response personnel, and Spill Management Team, oil spill removal organizations, and the qualified individual(s) ...	Table 3-1, Table 3-2
(b)(1)(i)(B)	Federal, State, or local agencies, as required.	Table 3-2
(b)(1)(ii)	... a form, ... which contains information to be provided in the initial and follow-up notifications to Federal, State, and local agencies ...	Table 3-3
(b)(2)	Facility's spill mitigation procedures.	§5.0
(b)(2)(i)	..describe the volume(s) and oil groups..	§5.0
(b)(2)(i)(A)...(D)	...discharges from the MTR facility ... non-transportation related...	§4.0, §5.0
(b)(2)(ii)	... must contain prioritized procedures for facility personnel to mitigate or prevent any discharge or substantial threat of a discharge of oil ...	§3.0, §4.0, §5.0
(b)(2)(ii)(A)...(G)	... Typical scenarios....	§4.0, §5.0, Figure 4.1
(b)(2)(iii)	... a listing of equipment and the responsibilities of facility personnel to mitigate an average most probable discharge.	§3.0, Table 3-4, Figure 3-7, Figure 3-8
(b)(3)	Facility's response activities.	---
(b)(3)(i)	... a description of the facility personnel's responsibilities ... pending the arrival of the qualified individual.	§3.0, EAP
(b)(3)(ii)	... a description of the responsibilities and authority of the qualified individual and alternate as required in § 154.1026.	§3.0
(b)(3)(iii)	... describe the corporate organizational structure that will be used to manage the response actions, including ...	§3.0, Figure 3-2
(b)(3)(iii)(A)..(H)	Command and control...Public Information...Safety...Liaison... Operations...Planning...Logistics...Finance	§3.0, Figure 3-2
(b)(3)(iv)	... identify the oil spill removal organization(s) and spill management team ...	---
(b)(3)(iv)(A)	Equipment and supplies to meet... §154.1045, §154.1047 or...	Table 3-4, Figure 3-7, Figure 3-8
(b)(3)(iv)(B)	Trained personnel necessary to continue operation... for 7 days of response.	§3.2, Figure 3-2
(b)(3)(v)	... job descriptions for each Spill Management Team member...	Figure 3-1, Figure 3-2 HSE-EAP-005
(b)(3)(vi)	For facilities... that operate in waters where dispersant use is pre-authorized ... list appropriately trained dispersant-application personnel...	---
(b)(3)(vi)(A)..(C)	... staging site...platform type...location...resource provider	---

Source: Amended by USCG-2001-8661, 74 FR 45023, August 30, 2009 (effective September 30, 2009)

Table 1-1 Regulatory Cross Reference Table

§154.1035	Brief Citation Description	SRPP Section
(b)(3)(vi)(A)(D)	...identify only the oil spill removal organization and not the information in (b)(3)(vi)(A) through (b)(3)(vi)(C)above	§3.2, Figure 3-3, Figure 3-4
(b)(3)(vii)	... list of resource providers... to provide aerial oil tracking capability...	---
(b)(3)(vii)(A)	The identification of a resource provider; and	---
(b)(3)(vii)(B)	Type and location of aerial surveillance aircraft ...	---
(b)(3)(viii)	For mobile facilities ... the oil spill removal organization and the Spill Management Team in the applicable geographic-specific appendix... in (b)(3)(iv)... for each COTP zone...	---
(b)(3)(ix)	For mobile facilities ... the oil spill removal organization and the Spill Management Team in the applicable geographic-specific appendix... in (b)(3)(iv)(A)... for each COTP zone...	---
(b)(4)	Fish and wildlife and sensitive environments.	§5.0
(b)(4)(i)	...identify areas of economic importance and environmental sensitivity..	§5.0
(b)(4)(ii)	For a worst case discharge...this section must..	---
(b)(4)(ii)(A)	List all fish and wildlife and sensitive environments identified in the ACP... ..	§5.0
(b)(4)(ii)(B)	Describe all the response actions ... to protect these fish and wildlife and sensitive environments...	§5.0
(b)(4)(ii)(C)	Contain a map or chart showing the location of those fish and wildlife and sensitive environments ...	§5.0
(b)(4)(iii)	For a worst case discharge, ... identify appropriate equipment and required personnel to protect these areas...	§5.0
(b)(4)(iii)(A)	Identify the appropriate equipment and required personnel to protect all fish and wildlife and sensitive environments ...	Table 3-4, Figure 3-7, Figure 3-8
(b)(4)(iii)(B)	Calculate the distances required by...by selecting one method described...	---
(b)(4)(iii)(B)(1)	Distances calculated...	---
(b)(4)(iii)(B)(1)(i)	For persistent oils... the distance from the facility... in 48 hours...	---
(b)(4)(iii)(B)(1)(ii)	For persistent oils... 15 miles from the facility down current during ebb tide...	§5.5
(b)(4)(iii)(B)(1)(iii)	For persistent oils... the distance from the facility... in 24 hours...	---
(b)(4)(iii)(B)(1)(iv)	For persistent oils... 5 miles from the facility down current during ebb tide...	---
(b)(4)(iii)(B)(2)	A spill trajectory or model may be substituted for distances...	---
(b)(4)(iii)(B)(3)	The procedures contained in the Environmental Protection Agency's regulations...may be substituted for distances...	---
(b)(4)(iii)(C)	Based on historical...COTP may require the additional fish and wildlife and sensitive environments	§5.5
(b)(5)	Disposal plan ...describe any actions to be taken or procedures to be used to ensure that all recovered oil and oil contaminated debris ...	§5.4, Table 5-3, HSE-ENV-610
(c)	<i>Training and exercises.</i> To be divided into the following subsections:	---
(c)(1)	Training procedures. ...must descr be the training procedures ...	§8.0
(c)(2)	Exercise procedures. ... must descr be the exercise program ...	§8.0
(d)	<i>Plan review and update procedures.</i> ... address the procedures ...	---
(e)	<i>Appendices.</i> ...must include appendices described...	---
(e)(1)	Facility-specific information... .. principal characteristics ...	Figure 1-7, ERAP
(e)(1)(i)	There must be a physical description of the facility...	Figure 1-7, ERAP
(e)(1)(ii)	...must identify the sizes, types, and number of vessels...	Table 2-1
(e)(1)(iii)	...must identify the first valve(s) ...inside the secondary containment...	Figure 2-4

Source: Amended by USCG-2001-8661, 74 FR 45023, August 30, 2009 (effective September 30, 2009)

Table 1-1 Regulatory Cross Reference Table

§154.1035	Brief Citation Description	SRPP Section
(e)(1)(iv)	...must contain information on the oil(s) and hazardous material...	MSDS
(e)(1)(iv)(A)	The generic or chemical name	MSDS
(e)(1)(iv)(B)	A description of the appearance and odor	MSDS
(e)(1)(iv)(C)	The physical and chemical characteristics	MSDS
(e)(1)(iv)(D)	The hazards involved in handling the oil(s) and hazardous...	MSDS
(e)(1)(iv)(E)	A list of firefighting procedures and extinguishing agents...	HSE-EAP-013
(e)(1)(v)	The appendix may contain any other information which the facility owner or operator determines to be pertinent...	---
(e)(2)	List of contacts...	---
(e)(2)(i)	The primary and alternate qualified individual(s) for the facility;	ERAP, Table 3-1
(e)(2)(ii)	The contact(s) ... for activation of the response resources; and	ERAP, Table 3-1
(e)(2)(iii)	Appropriate Federal, State, and local officials.	ERAP, Table 3-2
(e)(3)	Equipment list and records. ... must include ...	---
(e)(3)(i)	...list of equipment ... average most probable	§5.0, Table 3-4, Figure 3-7, Figure 3-8
(e)(3)(ii)	...detailed listing of all the major equipment identified in the plan as belonging to an oil spill removal organization(s)...	Figure 3-7, Figure 3-8
(e)(3)(iii)	It is not necessary to list response equipment from oil spill removal organization(s) ... classified by the Coast Guard ... When it is necessary ... the list must include for each piece of equipment -	---
(e)(3)(iii)(A)	The type, make, model, and year of manufacture ... of the equipment;	---
(e)(3)(iii)(B)	For oil recovery devices, the effective daily recovery rate ...	---
(e)(3)(iii)(C)	For containment boom, ...height and type of end connectors;	---
(e)(3)(iii)(D)	The spill scenario in which the equipment will be used ...	---
(e)(3)(iii)(E)	The total daily capacity for storage and disposal of recovered oil;	---
(e)(3)(iii)(F)	For communication equipment, the type and amount of equipment ...	---
(e)(3)(iii)(G)	Location of the equipment; and	---
(e)(3)(iii)(H)	The date of the last inspection by the oil spill removal organization(s).	---
(e)(4)	<i>Communications plan</i> ...	EAP
(e)(5)	<i>Site-specific safety and health plan</i> ...	ERAP
(e)(6)	<i>List of acronyms and definitions</i> ...	Acronyms, Table 1-2

Source: Amended by USCG-2001-8661, 74 FR 45023, August 30, 2009 (effective September 30, 2009)

Table 1-1 Regulatory Cross Reference Table

§154.1045	Brief Citation Description	SRPP Section
Response plan development and evaluation criteria for facilities that handle, store, or transport Group I through Group IV petroleum oils.		
(a)	...facility that handles...Group I through Group IV petroleum oils..	---
(a)(1)	..criteria in Table 1 ...identification of appropriate equipment..	---
(a)(2)	...resources must be evaluated...including, but not limited to -	---
(a)(2)(i)...(v)	Ice conditions; Debris; ... other appropriate...	---
(a)(3)(i)..(ii)	The COTP may reclassify a specific body of water or location ...	---
(b)(1)...(3)	Response equipment must ---	§5.0, Table 3-4, Figure 3-7, Figure 3-8
(c)	...identify response resources...average most probable discharge...	§5.2
(c)(1)	1,000 feet of containment boom or two times the length of the largest vessel ... and the means of deploying and anchoring the boom ... within 1 hour of the detection of a spill;	§5.2
(c)(2)	...recovery devices and oil storage capacity ... within 2 hours ...	§5.2
(d)	... identify response resources ... maximum most probable discharge...	§5.2
(d)(1)	... include sufficient containment boom, oil recovery devices, and storage capacity for any recovery of up to the maximum most probable discharge planning volume...	§5.2
(d)(2)	... resources must be appropriate for each group of oil ...	§5.2
(d)(3)	... must be positioned ... arrive ... scene of a discharge ...	§5.2
(d)(3)(i)	... within the specified times ...	§5.2
(d)(3)(ii)	In higher volume port areas ... within 6 hours ...	§5.2
(d)(3)(iii)	In all other locations, ... within 12 hours ...	§5.2
(d)(4)	... COTP may impose additional operational restrictions ...	---
(e)	... identify the response resources ... worst case discharge ...	§5.2
(e)(1)	The location must be suitable to meet the response times identified..	§5.2
(e)(2)	The response resources must be appropriate for ---	---
(e)(2)(i)	The volume of the facility's worst case discharge;	§5.2
(e)(2)(ii)	Group(s) of oil...handled, stored or transported by the facility; and	§5.2
(e)(2)(iii)	The geographic area(s) in which the facility operates.	§5.2
(e)(3)	... sufficient boom, oil recovery devices, and storage capacity to recover the worst case discharge planning volumes.	§5.2
(e)(4)	... quantity of response resources ... to respond ... to the worst case discharge to the maximum extent practicable.	§5.2
(e)(5)	... The following percentages of the response equipment ... must be capable of operating in waters of 6 feet or less depth.	---
(e)(5)(i)	Offshore - 10 percent.	---
(e)(5)(ii)	Nearshore/inland/Great Lakes/rivers and canals - 20 percent.	§5.2

Source: Amended by USCG-2001-8661, 74 FR 45023, August 30, 2009 (effective September 30, 2009)

Table 1-1 Regulatory Cross Reference Table

§154.1045	Brief Citation Description	SRPP Section
(e)(6)	... COTP may impose additional operational restrictions ...	---
(f)	Response equipment ... must be capable of arriving on scene within the times specified in this paragraph ...	§5.2
(g)	... response equipment identified for Tier 1 plan credit must be capable of being mobilized and en route to the scene of a discharge within 2 hours of notification ...	§5.2
(g)(1)	Either directly or through the qualified individual; and	§5.2
(g)(2)	Within 30 minutes of a discovery ...	§5.2
(h)	Response resources identified for Tier 2 and Tier 3 plan credit must be capable of arriving on scene within the time specified ...	§5.2
(i)	... a facility that handles, stores, or transports Group II through IV petroleum oils... must identify their response plan...	§3.6 , Table 3-4 , Figure 3-7 , Figure 3-8
(i)(1)	... must be capable of commencing dispersant-application operations at the site of a discharge within 7 hours...	§3.3.2
(i)(2)	Dispersant response resources must include all of the following:	§3.3.2
(i)(2)(i)	Sufficient volumes of dispersants for application as required by...	§3.3.2
(i)(2)(ii)	Dispersant-application platforms capable of delivering...	§3.3.2
(i)(2)(iii)	Dispersant-application systems that are consistent in design with...	§3.3.2
(i)(2)(iv)	Dispersant-application personnel trained in and capable of ...	§3.3.2
(i)(3)	Dispersant stockpiles, application platforms and other support resources must...	§3.3.2
(j)	... identify response resources necessary to provide aerial oil tracking.... The aerial oil tracking resources must:	§3.3.2
(j)(1)	Be capable of arriving at the site of the discharge... up to 50 miles from shore...	§3.3.2
(j)(2)	Be capable of support OSROs continuously for three 10-hour operational periods during the initial 72 hours of discharge.	§3.3.2
(j)(3)	Include appropriately located aircraft and personnel capable of...	§3.3.2
(j)(4)	Include sufficient number of aircraft, pilots, and trained observation personnel...	§3.3.2
(j)(4)(i)	The protocols of oil-spill reporting and assessment...	§3.3.2
(j)(4)(ii)	The use of assessment techniques in ASTM F1779-08...	§3.3.2
(k)	... identify response resources with firefighting capability ...	EAP , Table 3-4 ,
(l)	... identify equipment and required personnel ... to protect fish and wildlife and sensitive environments.	Table 3-1 , Table 3-4 ,
(l)(1)	... the identified response resources must include the quantities of boom sufficient to protect	Table 3-4 , Table 5-2
(l)(2)	... resources and response methods ... must be consistent with the ... ACP in effect 6 months prior to initial plan submission or the annual plan review ...	§5.2
(m)	The response plan for a facility that handles, stores, or transports Groups I through IV petroleum oils must identify an oil spill removal organization(s) with response resources that are available...	Figure 3-3 , Figure 3-4
(m)(1)	Except as required in paragraph (l)(2) ... shoreline clean-up response resources required must be determined as described in Appendix C of this part.	§5.2
(m)(2)	... resources and response methods ... must be consistent with the ... ACP in effect 6 months prior to initial plan submission or the annual plan review ...	§5.2

Source: Amended by USCG-2001-8661, 74 FR 45023, August 30, 2009 (effective September 30, 2009)

Table 1-1 Regulatory Cross Reference Table

§154.1045	Brief Citation Description	SRPP Section
(n)	Appendix C ... quantity of response resources ... for the maximum most probable discharge volume, and for each worst case discharge response tier.	§5.2
(n)(1)	Included in Appendix C of this part is a cap that recognizes the practical and technical limits of response capabilities ...	§5.2
(n)(2)	Table 5 in appendix C of this part lists the caps that will apply in ... February 18, 1998. ...facility whose estimated recovery capacity exceeds ... caps ... shall identify sources of additional equipment equal to twice the cap ... or the amount necessary to reach the calculated planning volume, whichever is lower.	§5.2
(o)(1)...(2)	The Coast Guard will initiate a review of cap increases and other requirements contained within this subpart ... best available technologies... oil spill tracking technology.	---

Source: Amended by USCG-2001-8661, 74 FR 45023, August 30, 2009 (effective September 30, 2009)

Table 1-1 Regulatory Cross Reference Table

40 CFR §112	Brief Citation Description	SRPP Section
112.3	Requirement to prepare and implement a Spill Prevention Control and Countermeasure Plan	---
(a,b,c)	Owners or operators must prepare and implement a Plan...	Entire Plan
(d)	A licensed Professional Engineer must review and certify a Plan for it to be effective...	Figure 1-2
(e)	Maintain a complete copy of the Plan at the facility if the facility is normally attended at least 4 hours per day, or at the nearest field office...	§2.0
112.5	Amendment of Spill Prevention Control and Countermeasures Plan by owners or operators	---
(a)	Amend the SPCC ...when there is a change in facility design, construction, operation or maintenance which materially affects the facility's potential for the discharge of oil...	§1.4
(b)	...complete a review and evaluation of the SPCC at least once every five years... amend the SPCC within six months of the review...implement within six months of preparation of any amendment.	§1.4
(c)	Have a Professional Engineer certify any technical amendment...	§1.4
112.7	Guidelines for the preparation and implementation of a Spill Prevention Control and Countermeasures Plan	---
----	...must prepare a Plan...have full approval of management...in writing.	Figure 1-6
----	If the plan calls for additional facilities or procedures, methods, or equipment not yet fully operational, these items should be discussed in separate paragraphs, and the details of installation and operational start-up should be explained separately.	---
----	...follow the sequence specified (or cross-reference)...	Table 1-1
(a)(2)	Comply with all applicable requirements in this part... [or] state reasons for non-conformance ... and describe alternate methods...	---
(a)(3)	Describe ... physical layout ... and include diagram	§2.0, Figure 2-2, Figure 2-4, Figure 2-5, Figure 2-6, Figure 2-7
(a)(3)(i)	... [address in your Plan] .. the type of oil in each container and its ... capacity ...	Table 2-1
(a)(3)(ii)	... discharge prevention measures including routine handling of products ...	§2.0, §7.0, §8.0
(a)(3)(iii)	...Drainage or discharge controls ... and procedures for control of a discharge ...	§2.0
(a)(3)(iv)	Countermeasures for discharge discovery, response, and cleanup (both ... facility's ... and contractor)	§5.0, §7.0, §8.0
(a)(3)(v)	Methods of disposal of recovered materials ...	§5.4
(a)(3)(vi)	Contact list and phone numbers ...	Table 3-1, Table 3-2
(a)(4)	Relate information ... [on a discharge] ...	Table 3-3
(a)(5)	Organize portions of the Plan ... that will make them readily usable....	TOC
(b)	Where experience indicates a reasonable potential for equipment failure...include in your plan a prediction of the direction, rate of flow....	§4.5
(c)(1)	Onshore facilities.	---
(c)(1)(i)	Dikes, berms or retaining walls sufficiently impervious to contain spilled oil	§2.0
(c)(1)(ii)	Curbing	---
(c)(1)(iii)	Sumps and collection systems	§2.0
(c)(1)(iv)	Culverting, gutters or other drainage systems	§2.0
(c)(1)(v)	Weirs, booms or other barriers	§2.0
(c)(1)(v)	Spill diversion ponds	§2.0
(c)(1)(vi)	Retention ponds	§2.0

Table 1-1 Regulatory Cross Reference Table

40 CFR §112	Brief Citation Description	SRPP Section
(c)(1)(vii)	Sorbent materials	§2.0
(c)(2)	Offshore Facilities.	---
(c)(2)(i)	Curbing, drip pans	---
(c)(2)(ii)	Sumps and collection systems	---
(d)	If you determine that the installation of structures or equipment listed in paragraphs (c) and (h)(1) of this section...is not practicable...clearly explain in your Plan...and provide...	---
(d)(1)	A strong oil spill contingency plan following...40 CFR 109.	§2.5, Table 2-6
(d)(2)	A written commitment of manpower, equipment and materials required to expeditiously control and remove any harmful quantity of oil discharged.	---
(e)	Inspection, tests, and records. ...in accordance with written procedures that you or the certifying engineer develop...with the SPCC Plan for a period of three years	---
(f)	Personnel, training and spill prevention procedures	---
(f)(1)	...train your oil-handling personnel in the operation and maintenance of equipment to prevent the discharges...	§7.0
(f)(2)	Designate a person...accountable for oil spill prevention...	---
(f)(3)	Schedule and conduct spill prevention briefings...highlight and describe known spill discharges...or failures, malfunctioning components, and recently developed precautionary measures.	§8.0
(g)	Describe in your Plan how you secure and control access to oil handling, processing, and storage areas...	Figure 1-6
(h)	Facility tank car and tank truck loading/unloading rack	§2.6
(h)(1)	Where loading/unloading area drainage does not flow into a catchment basin or treatment facility designed to handle discharges, use a quick drainage system... ..design any containment system to hold at least maximum capacity of any single compartment of a tank car or tank truck loaded or unloaded at the facility.	§2.6
(h)(2)	Provide an interlocked warning light or physical barrier system, warning signs, wheel chokes, or vehicle break to prevent vehicular departure before complete disconnect of flexible or fixed oil transfer lines.	§2.6
(h)(3)	Prior to filling and departure of any tank car or tank truck, closely inspect for discharges the lowermost drain and all outlets of such vehicles should be closely examined for leakage, and if necessary, that they are tightened, adjusted, or replaced to prevent liquid leakage while in transit.	§2.6
(i)	If a field-constructed aboveground container undergoes a repair, alteration, reconstruction, or change in service that might affect the risk of a discharge or failure due to brittle fracture...evaluate the container for risk...	§7.0
(j)	In addition...include a complete discussion of conformance with applicable requirements...or any more stringent, with State rules, regulations and guidelines.	§1.0
(k)	Qualified Oil-filled Operational Equipment; The owner or operator of a facility with oil-filled operational equipment that meets... may choose...	---
(k)(1)	Qualification Criteria—Reportable Discharge History: The owner or operator of a facility that has had no single discharge ...	---
(k)(2)	... If secondary containment is not provided for qualified oil-filled operational equipment...	---
(k)(2)(i)	Establish and document the facility procedures for inspections or a monitoring program to detect equipment failure and/or a discharge; and	---
(k)(2)(ii)	Unless you have submitted a response plan under § 112.20, provide in your Plan the following:	---
(k)(2)(ii)(A)	An oil spill contingency plan following the provisions of part 109...	---
(k)(2)(ii)(B)	A written commitment of manpower, equipment, and materials required to...	---

Table 1-1 Regulatory Cross Reference Table

40 CFR §112	Brief Citation Description	SRPP Section
112.8	Spill Prevention, Control, and Countermeasure Plan requirements for onshore facilities (excluding production facilities)	---
(a)	Meet the general requirements for the Plan listed under § 112.7, and...	---
(b)(1)	Restrain drainage from diked storage areas by valves or other positive means to prevent a spill...into the drainage system or in-plant effluent treatment system, except where plan systems are designed to handle such leakage. You may empty diked areas by pumps or ejectors; however you must be manually activate these pumps...and inspect the condition of the accumulation before starting...	§2.0
(b)(2)	Use valves of manual, open-and-closed design... If facility drainage drains directly into water course...you must inspect and drain uncontaminated retained storm water, as provided in...paragraphs (c)(3)(ii)(iii), and (iv).	§2.0
(b)(3)	Design facility drainage systems from undiked areas... to flow into ponds, lagoons or catchment basins, designed to retain oil or return it to the facility. You must not locate catchment basins in areas subject to periodic flooding.	§2.0
(b)(4)	If...not engineered as in paragraphs (b)(3), equip the final discharge of all ditches with a diversion system that would...retain the oil in the facility.	--
(b)(5)	Where drainage waters are treated in more than one treatment unit... provide two "lift" pumps and permanently install at least one of the pumps. Whatever techniques are used, facility drainage systems engineer... to prevent a discharge as described in § 112.1(b) in case there is an equipment failure or human error...	§2.0
(c)	Bulk storage containers (onshore)	---
(c)(1)	Not use a container for the storage of oil unless its material and construction are compatible with the material stored and conditions of storage...	§2.0
(c)(2)	Construct all bulk storage container installations so that you provide a secondary means of containment for the entire contents of the largest single container plus sufficient freeboard to allow for precipitation. You must ensure that diked areas are sufficiently impervious to contain discharged oil.	§2.0
(c)(3)	Not allow drainage of uncontaminated rainwater from the diked area into a storm drain or discharge of an effluent discharge into an open water course, lake, or pond, bypassing the in-plant treatment system unless you:	§2.0
(c)(3)(i)	Normally keep the bypass valve sealed closed.	§2.0
(c)(3)(ii)	Inspect the retained rainwater to ensure that its presence will not cause a discharge as described in § 112.1(b).	§2.0
(c)(3)(iii)	Open the bypass valve and reseal it following drainage...under responsible supervision.	§2.0
(c)(3)(iv)	Keep adequate records of such events.	§2.0
(c)(4)	Protect any completely buried metallic storage tank installed on or after January 10, 1974 from corrosion by coatings or cathodic protection...	§2.0
(c)(5)	Not use partially buried metallic tanks for the storage of oil unless the buried section of the tank is adequately coated...	§2.0
(c)(6)	Test each aboveground container for integrity testing on a regular schedule. Keep comparison records... In addition...frequently inspect the outside of the container for signs of deterioration, discharges, or accumulation of oil inside diked areas. Records of inspections and tests kept under usual and customary business practices will suffice for the purposes of this paragraph.	§2.0 , §7.0
(c)(7)	Control leakage through defective internal heating coils by monitoring the steam return and exhaust lines...	§2.0
(c)(8)	Engineer or update each container installation in accordance with good engineering practice to avoid discharges (and) provide at least one of the following devices:	§2.0
(c)(8)(i)	High liquid level alarms with an audible or visual signal at a constantly attended operation or surveillance station. In smaller facilities, an audible air vent may suffice.	§2.0

Table 1-1 Regulatory Cross Reference Table

40 CFR §112	Brief Citation Description	SRPP Section
(c)(8)(ii)	High liquid level pump cutoff devices set to stop flow at a predetermined container content level.	§2.0
(c)(8)(iii)	Direct audible or code signal communication between the container gauger and the pumping station.	§2.0
(c)(8)(iv)	A fast response system for determining the liquid level of each bulk storage container such as digital computers, telepulse, or direct vision gauges.	§2.0
(c)(8)(v)	You must regularly test liquid level sensing devices to ensure proper operation.	§2.0
(c)(9)	Observe effluent treatment facilities frequently enough to detect possible system upsets that could cause a discharge...	§2.0
(c)(10)	Promptly correct visible discharges which result in a loss of oil from container including...seam, gaskets, piping, pumps, valves...	§2.0
(c)(11)	Position or locate mobile or portable oil storage container to prevent a discharge as described in § 112.1(b)...furnish a secondary means of containment...for the largest single compartment or container with sufficient freeboard...	§2.0
(d)	Facility transfer operations, pumping, and facility process	---
(d)(1)	Provide buried piping... installed or replaced on or after August 16, 2002, with a protective wrapping and coating...cathodically protect. If a section of buried line is exposed...carefully inspect it for deterioration. If you find corrosion damage, you must undertake additional examination and corrective action as indicated...	§2.0
(d)(2)	Cap or blank-flange the terminal connection...and mark it as to origin when piping is not in service, or in standby service for an extended time.	§2.0
(d)(3)	Properly design pipe supports to minimize abrasion and corrosion and allow for expansion and contraction.	§2.0
(d)(4)	Regularly inspect all aboveground valves, piping, and appurtenances. ...also conduct integrity and leak testing on buried piping at the time of installation, modification, construction, relocation, or replacement.	§7.0
(d)(5)	Warn all vehicles entering the facility to be sure that no vehicle will endanger aboveground piping or other oil transfer operations.	§2.0

Source: 67 FR 47146, Jul. 17, 2002, as amended at 71 FR 77290 Dec. 26, 2006; 73 FR 74300 Dec. 5, 2008, eff. Jan. 14, 2010; 74 FR 5900, Feb. 3, 2009; 74 FR 14736, Apr. 1, 2009, eff. Jan. 14, 2010; 74 FR page 58809, Nov. 13, 2009; 76 FR page 21660, Apr. 18, 2011.

Table 1-1 Regulatory Cross Reference Table

40 CFR 112, App F Section No.	Brief Citation Description	SRPP Section
1.0	Model Facility- Specific Response Plan	---
1.1	Emergency Response Action Plan	ERAP
1.2	Facility Information	Figure 1-7
1.3	Emergency Response Information	---
1.3.1	Notification	Table 3-3
1.3.2	Response Equipment List	Table 3-4 , Figure 3-7 , Figure 3-8
1.3.3	Response Equipment Testing/Deployment	§8.0
1.3.4	Personnel	Table 3-1
1.3.5	Evacuation Plans	§3.8 , EAP
1.3.6	Qualified Individual's Duties	§3.5
1.4	Hazard Evaluation	---
1.4.1	Hazard Identification	
1.4.2	Vulnerability Analysis	§5.0
1.4.3	Analysis of the Potential for an Oil Spill	§4.0
1.4.4	Facility Reportable Oil Spill History	Table 4-3
1.5	Discharge Scenarios	---
1.5.1	Small and Medium Discharges	§4.0 , §5.0
1.5.2	Worst Case Discharge	§4.0
1.6	Discharge Detection by Personnel	---
1.6.1	Discharge Detection by Personnel	§7.0
1.6.2	Automated Discharge Detection	§7.0
1.7	Plan Implementation	---
1.7.1	Response Resources for Small, Medium and Worst Case Spills	§3.0 , §5.0
1.7.2	Disposal Plans	§5.0 , Table 5-3
1.7.3	Containment and Drainage Plans	§2.0 , Table 2-6
1.8	Self-Inspection, Drills/Exercises and Response Training	§7.0
1.8.1	Facility Self-Inspection	§7.0
1.8.1.1	Tank Inspection	Figure 7-1
1.8.1.2	Response Equipment Inspection	§7.0 , Figure 7-2
1.8.1.3	Secondary Containment Inspection	§2.0
1.8.2	Facility Drills / Exercises	§8.0 , EAP
1.8.2.1	Qualified Individual Notification Drill Logs	§8.0 , Figure 8-1 , EAP
1.8.2.2	Spill Management Team Tabletop Exercise Logs	§8.0 , Figure 8-1 , EAP
1.8.3	Response Training	§8.0 , EAP
1.8.3.1	Personnel Response Training Logs	§8.0 , Figure 8-2 , EAP
1.8.3.2	Discharge Prevention Meeting Logs	§8.0 , Figure 8-2 , EAP
1.9	Diagrams	§2.0 , Figure 2-1 , Figure 2-2
1.10	Security	§2.7
2.0	Response Plan Cover Sheet	ERAP
3.0	Acronyms	Acronyms
4.0	References	§1.0

Table 1-1 Regulatory Cross Reference Table

49 CFR §194	Brief Citation Description	SRPP Section
194.105(a)	... determine the worst case discharge ... provide methodology, including calculations, used to arrive at the volume.	---
(b)	The worst case discharge is the largest volume, in barrels, of the following:	---
(b)(1)	... maximum release time in hours, plus the maximum shutdown response time in hours, multiplied by the maximum flow rate expressed in barrels per hour, plus the largest line drainage volume after shutdown of the line section(s) ...; or	§4.0
(b)(2)	The largest foreseeable discharge for the line section(s) within a response zone, expressed in barrels, based on the maximum historic discharge, if one exists, adjusted for any subsequent corrective or preventative action taken; or	---
(b)(3)	If the response zone contains one or more breakout tanks, the capacity of the single largest tank or battery of tanks within a single secondary containment system, adjusted for the capacity or size of the secondary containment system, expressed in barrels.	§4.0
(b)(4)	Operators may claim prevention credits for breakout tank secondary containment and other specific spill prevention measures as follows:...	§4.0
194.107(a)	Each response plan must plan for resources for responding, to the maximum extent practicable, to a worst case discharge, and to a substantial threat of such a discharge.	---
(b)	An operator must certify in the plan ... reviewed NCP and each applicable ACP...	§1.4
(b)(1)	As a minimum to be consistent with the NCP as a facility response plan must:	---
(b)(1)(i)	Demonstrate an operator's clear understanding of the function of the Federal response structure...	EAP
(b)(1)(ii)	Establish provisions to ensure the protection of safety at the response site; and	EAP
(b)(1)(iii)	Identify the procedures to obtain any required Federal and State permissions for using alternative response strategies such as in-situ burning and dispersants...	§2.0
(b)(2)	As a minimum, to be consistent with the applicable ACP the plan must:	---
(b)(2)(i)	Address the removal of a worst case discharge and the mitigation or prevention of a substantial threat of a worst case discharge;	§3.0 , §5.0
(b)(2)(ii)	Identify environmentally and economically sensitive areas;	Figure 5-1
(b)(2)(iii)	Describe the responsibilities of the operator and operator and of Federal, State and local agencies in removing a discharge and in mitigating or preventing a substantial threat of a discharge; and	EAP
(b)(2)(iv)	Establish the procedures for obtaining an expedited decision on use of dispersants or other chemicals.	§2.0
(c)	Each response plan must include:	---
(c)(1)	A core plan consisting of ...	---
(c)(1)(i)	An information summary as required in §194.113,	Figure 1-7 , Figure 1-8
(c)(1)(ii)	Immediate notification procedures,	EAP , Table 3-1 , Table 3-2
(c)(1)(iii)	Spill detection and mitigation procedures,	Table 5-2
(c)(1)(iv)	The name, address, and telephone number of the oil spill response organization, if appropriate,	Table 3-2 , Figure 3-3 , Figure 3-4
(c)(1)(v)	Response activities and response resources,	§3.0 , Table 5-2
(c)(1)(vi)	Names and telephone numbers of Federal, state, and local agencies which the operator expects to have pollution control responsibilities or support,	Table 3-2
(c)(1)(vii)	Training procedures,	§8.0
(c)(1)(viii)	Equipment testing,	EAP

Table 1-1 Regulatory Cross Reference Table

49 CFR §194	Brief Citation Description	SRPP Section
(c)(1)(ix)	Drill program – an operator will satisfy the requirement for a drill program by following the National Preparedness for Response Exercise Program (PREP) guidelines. An operator choosing not to follow PREP guidelines must have a drill program that is equivalent to PREP. The operator must describe the drill program in the response plan and OPS will determine if the program is equivalent to PREP.	EAP
(c)(1)(x)	Plan review and update procedures;	§1.4
(c)(2)	An appendix for each response zone that includes the information required in paragraph (c)(1)(i)-(ix) of this section and the worst case discharge calculations that are specific to that response zone. An operator submitting a response plan for a single response zone does not need to have a core plan and a response zone appendix. The operator of a single response zone onshore pipeline shall have a single summary in the plan that contains the required information in §194.113.7; and.	---
(c)(3)	A description of the operator's response management system including the functional areas of finance, logistics, operations, planning, and command. The plan must demonstrate that the operator's response management system uses common terminology and has a manageable span of control, a clearly defined chain of command, and sufficient trained personnel to fill each position.	EAP
194.111(a)	Each operator shall maintain relevant portions of its response plan at the operator's headquarters and at other locations from which response activities may be conducted, for example, in field offices, supervisor's vehicles, or spill response trailers.	§1.4
194.113 (a)	The information summary for the core plan, required by §194.107, must include:	---
(a)(1)	The name and address of the operator.	Figure 1-7
(a)(2)	For each response zone which contains one or more line sections that meet the criteria for determining significant and substantial harm as described in §194.103, a listing and description of the response zones, including county(s) and state(s).	---
(b)	The information summary for the response zone appendix, required in §194.107, must include:	---
(b)(1)	The information summary for the core plan.	Figure 1-7, Figure 1-8
(b)(2)	The names or titles and 24-hour telephone numbers of the qualified individual(s) and at least one alternate qualified individual(s);	Figure 1-7
(b)(3)	The description of the response zone, including county(s) and state(s), for those zones in which a worst case discharge could cause substantial harm to the environment.	Figure 1-7
(b)(4)	A list of line sections for each pipeline contained in the response zone, identified by milepost or survey station number, or other operator designation.	Figure 2-7
(b)(5)	The basis for the operator's determination of significant and substantial harm.	Figure 1-8
(b)(6)	The type of oil and volume of the worst case discharge.	Table 2-1
194.115(a)	Each operator shall identify and ensure, by contract or other approved means, the resources necessary to remove, to the maximum extent practicable, a worst case discharge and to mitigate or prevent a substantial threat of a worst case discharge.	§3.0, Figure 3-3 thru 3-8
(b)	An operator shall identify in the response plan the response resources which are available to respond within the time specified, after discovery of a worst case discharge, or to mitigate the substantial threat of such a discharge.	Figure 3-3 thru 3-8
194.117(a)	Each operator shall conduct training to ensure that:	---
(a)(1)	All personnel know –	---
(a)(1)(i)	Their responsibilities under the response plan	§8.0
(a)(1)(ii)	The name and address of, and the procedure for contacting, the operator on a 24-hour basis	Figure 1-7

Table 1-1 Regulatory Cross Reference Table

49 CFR §194	Brief Citation Description	SRPP Section
(a)(1)(iii)	The name of, and procedures for contacting, the qualified individual on a 24-hour basis	Figure 1-7, Table 3-1
(a)(2)	Reporting personnel know --	---
(a)(2)(i)	The content of the information summary of the response plan.	§8.0, Figure 1-7, Table 3-3
(a)(2)(ii)	The toll-free telephone number of the National Response Center	Table 3-2
(a)(2)(iii)	The notification process	§3.0, EAP
(a)(3)	Personnel engaged in response activities know --	---
(a)(3)(i)	The characteristics and hazards of the oil discharged	MSDS
(a)(3)(ii)	The conditions that are likely to worsen emergencies, including the consequences of facility malfunctions or failures, and the appropriate corrective actions.	§5.0
(a)(3)(iii)	The steps necessary to control any accidental discharge of oil and to minimize the potential for fire, explosion, toxicity, or environmental damage	§5.0
(a)(3)(iv)	The proper firefighting procedures and use of equipment, fire suits, and breathing apparatus	EAP
(b)	Each operator shall maintain a training record for each individual that has been trained as required by this section. These records must be maintained in the following manner as long as the individual is assigned duties under the response plan	---
(b)(1)	Records for operator personnel must be maintained at the operator's headquarters	§8.0
(b)(2)	Records for personnel engaged in response, other than operator personnel, shall be maintained as determined by the operator.	§8.0
(b)(3)	Nothing in this section relieves an operator from the responsibility to ensure that all response personnel are trained to meet the OSHA standards for emergency response operations in 29 CFR 1910.120 ...	§8.0
194.119(a)	Each owner shall submit two copies...	§1.0
(b)	...PHMSA will notify the operator of any alleged deficiencies...	---
(c)	The operator...may petition PHMSA for reconsideration within 30 days...	---
(d)	...PHMSA will approve the Response Plan...	---
(e)	...The operator may submit a certification to PHMSA...that the operator has obtained, through contract or other approved means, the necessary private personnel and equipment to record, to the maximum extent practicable, to a worst case discharge...	Figure 1-4
(f)	...PHMSA may require an operator to provide a copy of the response plan to the OSC...	---
194.121(a)	Each operator shall update its response plan to address new or different operating conditions or information. In addition, each operator shall review its response plan in full at least every 5 years from the date of the last submission or the last approval as follows:	Figure 1-4
(a)(1)	For substantial harm plans, an operator shall resubmit every 5 years from the last approval date.	Figure 1-4
(a)(2)	For significant and substantial harm plans, an operator shall resubmit every 5 years from the last approval date.	---
(b)	If a new or different operating condition or information would substantially affect the implementation of a response plan, the operator must immediately modify its response plan to address such a change...	Figure 1-4
(b)(1)	An extension of the existing pipeline or construction of a new pipeline in a response zone not covered by the previously approved plan;	Figure 1-4
(b)(2)	Relocation or replacement of the pipeline in a way that substantially affects the information included in the response plan, such as a change to the worst case discharge volume;	Figure 1-4

Table 1-1 Regulatory Cross Reference Table

49 CFR §194	Brief Citation Description	SRPP Section
(b)(3)	The type of oil transported, if the type affects the required response resources, such as a change from crude oil to gasoline;	Figure 1-4
(b)(4)	The name of the spill removal organization;	Figure 1-4
(b)(5)	Emergency response procedures;	Figure 1-4
(b)(6)	The qualified individual;	Figure 1-4
(b)(7)	A change in the NCP or an ACP that has significant impact on the equipment appropriate for response activities; and	Figure 1-4
(b)(8)	Any other information relating to circumstances that may affect full implementation of the plan.	Figure 1-4
(c)	If PHMSA determines that a change to a response plan does not meet the requirements of this part, PHMSA will notify the operator of any alleged deficiencies, and provide operator...opportunity to correct deficiencies.	---
(d)	An operator who disagrees with a determination that proposed revisions to a plan are deficient may petition PHMSA for reconsideration, within 30 days from the date of receipt of PHMSA's notice...	---

Source: 58 FR 253, Jan. 5, 1993, as amended by 194-1, 62 FR 67293, Dec. 24, 1997; 194-4, 70 FR 8748, Feb. 23, 2005; and 70 FR 11140, Mar. 8, 2005

Table 1-1 Regulatory Cross Reference Table

49 CFR 194, App A Section No.	Brief Citation Description	SRPP Section
1	Information Summary	ERAP, §2.0, §4.0
2	Notification Procedures	§3.0, §6.0, EAP
3	Spill Detection and On-Scene, Spill Mitigation Procedures	§3.0, §5.0
4	Response Activities	§3.0, §5.0, EAP
5	List of Contacts	§3.0, EAP
6	Training Procedures	§8.0, EAP
7	Drill Procedures	§8.0, EAP
8	Response Plan Review and Update Procedures	§1.4
9	Response Zone Appendices	§2.0

Table 1-2 Definitions

The definitions listed below are from §33 CFR 154.1020 and §33 CFR 154.105.

§33 CFR 154.1020:

Adverse weather means the weather conditions that will be considered when identifying response systems and equipment in a response plan for the applicable operating environment. Factors to consider include significant wave height as specified in §154.1045, §154.1047, or §154.1049, as appropriate, ice conditions, temperatures, weather-related visibility, and currents within the COTP zone in which the systems or equipment are intended to function.

Average most probable discharge means a discharge of the lesser of 50 barrels or 1 percent of the volume of the worst-case discharge.

Captain of the Port (COTP) Zone means a zone specified in §33 CFR Part 3 and, where applicable, the seaward extension of that zone to the outer boundary of the exclusive economic zone (EEZ).

Exclusive economic zone (EEZ) means the zone contiguous to the territorial sea of the United States extending to a distance up to 200 nautical miles from the baseline from which the breadth of the territorial sea is measured.

Facility that could reasonably be expected to cause significant and substantial harm means any MTR facility (including piping and any structures that are used for the transfer of oil between a vessel and facility) classified as a "significant and substantial harm" facility under §154.1015 (c) including a facility specifically designated by the COTP under §154.1016(a).

Facility that could reasonably be expected to cause substantial harm means any MTR facility classified as a "substantial harm" facility under §154.1015 (b) including a facility specifically designated by the COTP under §154.1016(a).

Great Lakes means Lakes Superior, Michigan, Huron, Erie, and Ontario, their connecting and tributary waters, the Saint Lawrence River as far as Saint Regis, and adjacent port areas.

Table 1-2 Definitions

Higher volume port area means the following ports:

1. Boston, MA.
2. New York, NY.
3. Delaware Bay and River to Philadelphia, PA.
4. St. Croix, VI.
5. Pascagoula, MS.
6. Mississippi River from Southwest Pass, LA. to Baton Rouge, LA.
7. Louisiana Offshore Oil Port (LOOP), LA.
8. Lake Charles, LA.
9. Sabine - Neches River, TX.
10. Galveston Bay and Houston Ship Channel, TX.
11. Corpus Christi, TX.
12. Los Angeles/Long Beach Harbor, CA.
13. San Francisco Bay, San Pablo Bay, Carquinez Strait, & Suisun Bay to Antioch, CA.
14. Straits of Juan De Fuca from Port Angeles, WA to and including Puget Sound, WA.
15. Prince William Sound, AK

Inland area means the area shoreward of the boundary lines defined in §46 CFR Part 7, except in the Gulf of Mexico. In the Gulf of Mexico, it means the area shoreward of the lines of demarcation (COLREG lines) defined in §80.740 through §80.850 of this chapter. The inland area does not include the Great Lakes.

Inland area means the area shoreward of the boundary lines defined in §46 CFR Part 7, except in the Gulf of Mexico. In the Gulf of Mexico, it means the area shoreward of the lines of demarcation (COLREG lines) defined in §80.740 through §80.850 of this chapter. The inland area does not include the Great Lakes.

Marine transportation-related facility (MTR facility) means any onshore facility or segment of a complex regulated under section §311(j) of the Federal Water Pollution Control Act (FWPCA) by two or more Federal agencies, including piping and any structure used or intended to be used to transfer oil to or from a vessel, subject to regulation under this part and any deepwater port subject to regulation under part 150 of this chapter. For a facility or segment of a complex regulated by two or more Federal agencies under section §311(j) of the FWPCA, the MTR portion of the complex extends from the facility oil transfer system's connection with the vessel to the first valve inside the secondary containment surrounding tanks in the non-transportation related portion of the facility or, in the absence of secondary containment, to the valve or manifold adjacent to the tanks comprising the non-transportation-related portion of the facility, unless another location has otherwise been agreed to by the COTP and the appropriate Federal official.

Table 1-2 Definitions

Maximum extent practicable means the planned capability to respond to a worst case discharge in adverse weather, as contained in a response plan that meets the criteria in this subpart or in a specific plan approved by the cognizant COTP.

Maximum most probable discharge means a discharge of the lesser of 1,200 barrels or 10 percent of the volume of a worst-case discharge.

Near shore area means the area extending seaward 12 miles from the boundary lines defined in §46 CFR Part 7, except in the Gulf of Mexico. In the Gulf of Mexico, it means the area extending seaward 12 miles from the line of demarcation (COLREG lines) defined in §80.740 through §80.850 of this chapter.

Non-persistent or Group I Oil means a petroleum-based oil that, at the time of shipment, consists of hydrocarbon fractions:

1. At least 50s of which by volume, distill at a temperature of 340 degrees C (645 deg F); and
2. At least 95% of which by volume, distill at a temperature of degrees C (700 deg F).

Non-petroleum oil means oil of any kind that is not petroleum based. It includes, but is not limited to, animal and vegetable oils.

Ocean means the **offshore area and near shore** area as defined in this subpart.

Offshore area means the area beyond 12 nautical miles measured from the boundary lines defined in §46 CFR part 7 extending seaward to 50 nautical miles, except in the Gulf of Mexico. In the Gulf of Mexico, it is the area beyond 12 nautical miles of the line of demarcation (COLREG lines) defined in §80.740 through §80.850 of this chapter extending seaward to 50 nautical miles.

Oil means oil of any kind or in any form, including, but not limited to, petroleum oil, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredge spoil.

Oil spill removal organization means an entity that provides response resources.

On-Scene Coordinator (OSC) means the definition in the National Oil and Hazardous Substances Pollution Contingency Plan (§40 CFR part 300).

Operating area means rivers and canals, inland, near shore, Great Lakes, or offshore geographic location(s) in which a facility is handling, storing, or transporting oil.

Table 1-2 Definitions

Operating environment means rivers and canals, inland, Great Lakes, or ocean. These terms are used to define the conditions in which response equipment is designed to function.

Operating in compliance with the plan means operating in compliance with the provisions of this subpart including, ensuring the availability of the response resources by contract or other approved means, and conducting the necessary training and drills.

Persistent oil means petroleum-based oil that does not meet the distillation criteria for non-persistent oil. For the purposes of this subpart, persistent oils are further classified based on specific gravity as follows:

1. Group II-specific gravity less than .85.
2. Group III-specific gravity between .85 and less than .95.
3. Group IV-specific gravity .95 or greater.
4. Group V-specific gravity greater than 1.0.

Qualified individual and alternate qualified individual means a person located in the United States who meets the requirements of §154.1026.

Response activities means the containment and removal of oil from the land, water, and shorelines, the temporary storage and disposal of recovered oil, or the taking of other actions as necessary to minimize or mitigate damage to the public health or welfare or the environment.

Response resources mean the personnel, equipment, supplies, and other capability necessary to perform the response activities identified in a response plan.

Rivers and canals means a body of water confined within the inland area, including the Intracoastal Waterways and other waterways artificially created for navigation that has a project depth of 12 feet or less.

Spill management team means the personnel identified to staff the organizational structure identified in a response plan to manage response plan implementation.

Substantial threat of a discharge means any incident or condition involving a facility that may create a risk of discharge of oil. Such incidents include, but are not limited to storage tank or piping failures, above ground or underground leaks, fires, explosions, flooding, spills contained within the facility, or other similar occurrences.

Table 1-2 Definitions

Worst-case discharge means in the case of an onshore facility and deepwater port, the largest foreseeable discharge in adverse weather conditions meeting the requirements of §154.1029.

§33 CFR 154.105:

Barrel means a quantity of liquid equal to 42 U.S. gallons.

Captain of the Port (COTP) means the U.S. Coast Guard officer commanding a Captain of the Port Zone described in Part 3 of this chapter, or that person's authorized representative.

Commandant means the Commandant of the Coast Guard or an authorized representative.

Contiguous Zone means the entire zone established by the United States under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone, but not extending beyond 12 miles from the baseline from which the breadth of the territorial sea is measured.

Contiguous Zone means the entire zone established by the United States under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone, but not extending beyond 12 miles from the baseline from which the breadth of the territorial sea is measured.

District Commander means the officer of the Coast Guard designated by the Commandant to command a Coast Guard District, as described in Part 3 of this chapter or an authorized representative.

Facility means either an onshore facility or an offshore facility and includes, but is not limited to structures, equipment, and appurtenances thereto, used or capable of being used to transfer oil or hazardous material to or from a vessel or a public vessel. A facility includes federal, state, municipal, and private facilities.

Facility operator means the person who owns, operates, or is responsible for the operation of the facility.

Hazardous material means a liquid material or substance, other than oil or liquefied gases, listed under §46 CFR 153.40(a), (b), (c), or (e).

MARPOL 73/78 means the International Convention for the Prevention of Pollution from Ships, 1973 (done at London, November 2, 1973) as modified by the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (done at London, February 17, 1978).

Table 1-2 Definitions

Mobile facility means any facility that can readily change location, such as a tank truck or tank car, other than a vessel or public vessel.

Monitoring device means any fixed or portable sensing device used to monitor for a discharge of oil or hazardous material onto the water, within or around a facility, and designed to notify operating personnel of a discharge of oil or hazardous material.

Officer in Charge, Marine Inspection (OCMI) means the U.S. Coast Guard officer commanding a Marine Inspection Zone described in Part 3 of this chapter, or an authorized representative.

Offshore facility means any facility of any kind located in, on, or under any of the navigable waters of the United States other than a vessel or a public vessel.

Oil means oil of any kind or in any form, including but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil.

Person in charge means an individual designated as a person in charge of transfer operations under §154.710 (for facilities) or §155.700 (for vessels) of this chapter.

Tank barge means any tank vessel not equipped with a means of self-propulsion.

Tank vessel means any vessel that carries oil or hazardous material in bulk as cargo or in residue.

Transfer means any movement of oil or hazardous material to, from, or within a vessel by means of pumping, gravitation, or displacement.

Vessel operator means a person who owns, operates, or is responsible for the operation of a vessel.

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
02/29/96	IS-1 to IS-5	Change telephone numbers and alternate qualified individuals.	JMB
02/29/96	1-4	Record changes to Plan in Table 1-1	JMB
02/29/96	Appendix Q	Replace entire List of Hazardous Substances and Reportable Quantities.	JMB
09/25/96	IS-1 to IS-5	Change to alternate qualified individuals	JMB
09/25/96	1-4	Record changes to Plan in Table 1-1	JMB
09/25/96	Appendix I	Replace entire Spill Response and Prevention SOP	JMB
02/28/97	1-4	No changes made to Plan as a result of the annual review	JMB
03/28/97	i to iv	Update the Table of Contents	JMB
03/28/97	3-6a, 3-6b	Replace pages to add spill flow direction determination section	JMB
03/28/97	5-11, 5-12, Appendix K	Add detailed drawings that show response activities for Spills in the Houston Ship Channel	JMB
03/28/97	1-4	Record changes to Plan in Table 1-1	JMB
05/06/97	3-4, 3-7, 3-8, Appendix L	Update spill Response contractor information per TXGLO letter of 4-28-97	JMB
05/06/97	1-4	Record changes to Plan in Table 1-1	JMB
06/19/98	iv	Update Table of Contents	MJG
06/19/98	2-1, 2-2	Update Facility description	MJG
06/19/98	3-1, 3-2, 3-3	Update Spill Response Information	MJG
06/19/98	5-3, 5-6, 8-1, 8-2	Minor verbiage revisions for consistency with other sections	MJG
06/19/98	Fig. 2-2	Replace with updated version	MJG
06/19/98	Appendix I	Replace with updated procedures	MJG
06/19/98	1-4	Record changes to Plan in Table 1-1	MJG
07/19/98	Appendix J	Replace with updated equipment inventory	MJG
07/19/98	1-4	Record changes to Plan in Table 1-1	MJG
04/09/99	ERAP	Replace with updated pages to address EPA NOD	MM
04/09/99		Replace with updated pages to address EPA NOD	MM
04/09/99	IS-1	Replace with updated pages to address EPA NOD	MM
04/09/99	IS-2	Replace with updated pages to address EPA NOD	MM
04/09/99	iii TOC	Replace with updated pages to address EPA NOD	MM
04/09/99	2-2	Replace with updated pages to address EPA NOD	MM
04/09/99	2-7	Replace with updated pages to address EPA NOD	MM
04/09/99	Page 3-3	Replace with updated pages to address EPA NOD	MM
04/09/99	Figure 3-0	Replace with updated pages to address EPA NOD	MM
04/09/99	Figure 3-0(a)	Replace with updated pages to address EPA NOD	MM

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
04/09/99	3-6b	Replace with updated pages to address EPA NOD	MM
04/09/99	3-6c	Replace with updated pages to address EPA NOD	MM
04/09/99	3-7	Replace with updated pages to address EPA NOD (Figure 3-1)	MM
04/09/99	3-7	Evacuation Plan – cover page and EAP inserts (11 pages total)	MM
04/09/99	4-1	Replace with updated pages to address EPA NOD	MM
04/09/99	4-2	Replace with updated pages to address EPA NOD	MM
04/09/99	5-5.1	Replace with updated pages to address EPA NOD	MM
04/09/99	5-5.2	Replace with updated pages to address EPA NOD	MM
04/09/99	5-5.3	Replace with updated pages to address EPA NOD	MM
04/09/99	5.5.4	Replace with updated pages to address EPA NOD	MM
04/09/99	5-22.1	Replace with updated pages to address EPA NOD	MM
04/09/99	7-1	Replace with updated pages to address EPA NOD	MM
04/09/99	Table 8-2	Replace with updated pages to address EPA NOD	MM
04/09/99	EAP Inserts	Replace with updated pages to address EPA NOD (training and drills – 20 pages total)	MM
04/09/99	A-2, B-1	Replace with updated pages to address EPA NOD	MM
04/09/99	D-1	Replace with updated pages to address EPA NOD	MM
04/09/99	Appendix F Cover	Replace with updated pages to address EPA NOD	MM
04/09/99	F-1	Replace with updated pages to address EPA NOD	MM
04/09/99	F-2	Replace with updated pages to address EPA NOD	MM
04/09/99	Fire Fighting	Replace with updated pages to address EPA NOD	MM
04/09/99	Resources Diagram	Replace with updated pages to address EPA NOD	MM
04/09/99	Figure I-1	Replace with updated pages to address EPA NOD	MM
04/09/99	Appendix J	Replace with updated pages to address EPA NOD	MM
04/09/99	N-1 – N-7	Replace with updated pages to address EPA NOD	MM
04/09/99	Cover	Replace with updated pages reflecting company name change	MM
04/09/99	IS-3	Replace with updated pages to address EPA NOD	MM
04/09/99	IS-4	Replace with updated pages to address EPA NOD	MM
04/09/99	i, TOC	Replace with updated pages to address EPA NOD	MM
04/09/99	ii, TOC	Replace with updated pages to address EPA NOD	MM
04/09/99	1-1	Replace with updated pages to address EPA NOD	MM
04/09/99	1-5	Replace with updated pages to address EPA NOD	MM
04/09/99	2-1	Replace with updated pages to address EPA NOD	MM
04/09/99	Figure 1-1	Replace with updated pages to address EPA NOD	MM

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
04/09/99	Figure 1-3	Replace with updated pages to address EPA NOD	MM
04/09/99	B-1	Replace with updated pages to address EPA NOD	MM
08/24/99	ERAP-16	Updates from USCG Inspection	MM
08/24/99	TOC page iii	Updates from USCG Inspection	MM
08/24/99	Pages 1-2, 1-3, Table 1-1	Updates from USCG Inspection	MM
08/24/99	Dock Line Tables after Figure 2-8	Updates from USCG Inspection	MM
08/24/99	Page 3-6a, Figure 3-1, Figure 3-2. EAP inserts	Updates from USCG Inspection	MM
08/24/99	9 pages total after Figures 3-1 and 3-2	Updates from USCG Inspection	MM
08/24/99	5-2 thru 5-5	Updates from USCG Inspection	MM
08/24/99	8-3	Updates from USCG Inspection	MM
08/24/99	Appendix A-1, A-1.1, A-1.2, A-1.3, A-1.4, A-1.5	Updates from USCG Inspection	MM
08/24/99	New Firewater Pump diagram to be inserted into App. F	Updates from USCG Inspection	MM
08/24/99	Figure I-1 Site Safety Plan after Figure I-1	Updates from USCG Inspection	MM
10/04/99	Appendix G	Revisions to Dock Standard Operating Procedures	MM
01/10/00	Appendix C	Revised High Volume Hydrocarbons, and revised MSDS sheets.	MM
01/10/00	Appendix D	Revised tank summary data table.	MM
01/10/00	Appendix N	Update Reportable Oil Spill History.	MM
01/30/00	Figure 1-3, Attachment 1	"Certificate of Response Preparedness" Signed by Anne Marie Ainsworth	MM
12/15/00	Figure 1- 1	"Management Commitment" Form Signed by William F. Thompson	MM
12/15/00	Figure 1-3, Attachment 1	"Certification of Response Preparedness" form, Signed by William F. Thompson	MM
12/15/00	Figure 1-3, Attachment 1	"Certification of Response Preparedness" form, Signed by William F. Thompson	MM

12/15/00	Table 2-3: Environmental Permits.	Remove page 2-12 and replace with new Table 2-2. (Revised with new renewal dates).	MM
11/20/01	ERAP	Revised Evacuation Procedure & Emergency Planning and Training Plan	MM
11/20/01	Preface, pages IS-1 and IS-2	Name change	MM
11/20/01	1-1 thru 1-3	Minor revisions. Updated Table 1-1.	MM
11/20/01	2-1 thru 2-9	Minor revisions. Replaced pp 2-1 thru 2-11 with pp 2-1 thru 2-9	MM
11/20/01	Table 2-1	Minor revisions. Replace Table 2-1	MM
11/20/01	Figure 2-3	Minor revisions. Remove Figure 2-3	MM
11/20/01	3-1 and 3-2	Minor revisions due to Reduction of duplication in plan.	MM
11/20/01	Remove "Evacuation and Personnel Accounting Procedures".	Minor revisions due to Reduction of duplication in plan.	MM
11/20/01	6-1	Minor revisions to 6-1. Revised pages 6-2 & 6-3 are site-specific hazardous materials lists.	MM
11/20/01	6-2 and 6-3	Minor revisions to 6-1. Added pages 6-2 & 6-3 are site-specific hazardous materials lists.	MM
11/20/01	Attachment 2	Replace these with updated procedures.	MM
11/20/01	Attachment 31 - 35	Replace these with updated procedures.	MM
11/20/01	A-1, A-1.1, A1.2, A-1.3, A-1.4, and A-1.5	Minor revisions – added new pages	MM
11/20/01	D-1	Minor revisions – added new pages	MM
11/20/01	Appendix E	Replace all pages of Appendix E with new pages Revisions to tank basin volumes.	MM
11/20/01	Appendix G.	Updated and replaced all Dock SOPs	MM
11/20/01	Appendix I	Insert a reference to the revised "Emergency Response Notification Systems" to the ERAP at the front of the plan.	MM
11/20/01	Appendix K	Add certifications to both sections. Remove Clean Channel Response Manual and replace with new one.	MM
11/20/01	N-1 thru N-11	Updated and replaced spill history.	MM
11/20/01	P-1, P-2, P-3	Minor revisions – updates	MM
11/20/01	Appendix Q	Added site-specific hazardous and extremely hazardous list inserted into Section 6.0.	MM
11/20/01	Appendix Q	Remove everything and insert page to reference back to Section 6.0 of the plan.	MM

09/30/02	ERAP	Added new front page of ERAP	MM
09/30/02	ERAP	Added new TOC	MM
09/30/02	ERAP	Revised "How to Report an Incident or Emergency"	MM
09/30/02	ERAP	Added new Figure 3.0	MM
09/30/02	ERAP	Added new Figure 3.0(a)	MM
09/30/02	ERAP	Added new Table 3-1	MM
09/30/02	ERAP	Added new LCR Spill Response Equipment Inventory.	MM
09/30/02	Table 1-1	Revised Record of Change/Review to reflect revisions for 2002.	MM
09/16/02	Section 2	Revised format of text, revised description of facility to more accurately reflect the names of types of units, and included information on secondary containment for all Docks, including Dock C (Section 2.4).	MM
09/16/02	Section 3	Revised the format of the text. Revised tables and figures to provide updated telephone numbers, and on contracted response capabilities (Garner and Clean Channel Association). Revised "Emergency Operations" description, site security and control description, and emergency response command description.	MM
09/16/02	4-2	Section 4.4: Updated oil spill history reference.	MM
09/30/02	7-1 and 7-2	Revised to include a description of secondary containment for block valves at Dock C.	MM
09/16/02	Section 8, Attachment 2	Updated the Emergency Management Training and Exercise Planning Schedule thru 2003. Notification Drills for QI updated to weekly and annually, rather than quarterly and annually.	MM
09/17/02	Appendix D	Revised Tank Failures: Supplement to the Storage Tank Summary Table thru YTD 2002.	MM
09/17/02	Appendix E	Revised Tanks with Tank Dike Walls as Secondary Containment to reflect reference to 40 CFR Part 112.8	MM
09/17/02	Appendix F	Revised Drainage Basins to more clearly define Outfall 002	MM
09/17/02	Appendix G	Annual review of Dock Emergency Operating Procedures: Revisions, and new EOPs.	MM
09/18/02	Appendix I	Revised SOP: Report an Incident or an Emergency	MM
09/30/02	Appendix J	Revised information on LCR's spill response equipment inventory.	MM
09/18/02	Appendix K	Increased response capabilities and new Spill Response Contractor Information (Garner Environmental).	MM

10/01/02	Appendix N	Revised Reportable Oil Spill History information to include thru YTD (September, 2002)	MM
09/12/02	Appendix O:	Revised On-Site Waste Activities SOP	MM
06/24/03	Table 1-1	Updated Record of Revisions	MM
06/24/03	Figure 3.0	Minor revisions to Emergency Response Procedures	MM
06/24/03	Figure 3.0	Revised names for Qualified Individuals and Emergency Response Members	MM
06/24/03	Section 3	Revisions to Site Security description	MM
06/24/03	Section 3	Minor revisions to "Emergency Operations" SOP and "Emergency Response Command" SOP.	MM
06/24/03	5-13	Addition of names and telephone numbers for contacts on wildlife rehabilitation.	MM
06/24/03	Section 8	Minor revisions to "Emergency Management Training and Exercise Planning Schedules", "ERT Spill Team Trainings and Drill Guidelines", a new "ERT Spill Drill – Quarterly Drill", revised "Spill Drill – Unannounced Drill", and revised "Notification Drill (Annual) – QI Notification Exercise.	MM
06/24/03	Appendix D	Updated History of Tank Failures	MM
06/24/03	Appendix G	Revised Marine Docks Operating and Emergency Procedures.	MM
06/24/03	Appendix K	Revised telephone numbers for Clean Channel Association Emergency Telephone Numbers.	MM
06/24/03	Appendix N:	Updated Reportable Oil Spill History thru June 1, 2003	MM
06/24/03	Appendix P	Revised Waste Transporters and Disposal Facilities lists of waste transporters and disposal facilities.	MM
08/24/04	Figure 3.0(A)	Due to telephone contact changes replaced Figure 3.0(A) in the EARP.	RMA Inc
08/24/04	EARP	Added Emergency Management Training and Exercise Plan to the back of the EARP.	RMA Inc
08/24/04	1-1 thru 1-3	Due to wording changes related to the new guidance by EPA replaced the Introduction pages including updated signature pages to the Spill Plan..	RMA Inc
08/24/04	1-4h	Added the revision tracking page to the back of Table 1.	RMA Inc
08/24/04	Table 1-1	Added Record of revision page to back of Table 1-1 after completion.	RMA Inc
08/24/04	2-1 thru 2-12	Based on a change to update wording in section 2, replace pages 2-1 thru the end of table 2-2.	RMA Inc
08/24/04	3-1 thru 3-6	Based on new Federal guidelines numerous changes to the Spill Response Plan replaced pages 3-1 thru 3-6.	RMA Inc
08/24/04	Table 3.0 and 3.0A	Based on an update in contact information replaced table 3.0 and 3.0A.	RMA Inc

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
08/24/04	5-1 thru 5-6	Based on new Federal guidelines numerous changes to the Spill Mitigation Procedures replaced pages 5-1 thru 5-6.	RMA Inc
08/24/04	Figure 5-1 thru 5-2	To update the "Environmentally Sensitive" area map Removed Figure 5-1 and 5-2 from the spill plan and replaced with pages 5-1a to 5-1d.	RMA Inc
08/24/04	A-2 thru A-3	To add new regulatory cross reference information, removed pages A-2 and A-3, and replace with pages A-2a thru A-3.	RMA Inc
08/24/04	D-1 thru D-32	Updated the "Tanks Table" for improved readability and minor corrections.	RMA Inc
08/24/04	E-1 thru E-3	Based on revised wording replaced Appendix E-1 thru E-3.	RMA Inc
08/24/04	Appendix J	To ensure the most up-to-date equipment inventory list in Appendix J, replaced "Spill Response Equipment Inventory" page.	RMA Inc
08/24/04	Appendix K	To reflect a better description of contents in Appendix K The title page "Contractor Spill Equipment" was replaced with the new title page, "Contractor and GLO Spill Equipment".	RMA Inc
08/24/04	Appendix K	Added the GLO equipment map to the back of Appendix K	RMA Inc
08/24/04	N-18	Updated information	RMA Inc
08/25/05	Figure 3.0 (EARP)	Updated Internal Notification information	MRC
08/25/05	Figure 3.0 (EARP)	Updated External Notification information	MRC
08/25/05	Figure 3.0	Updated Internal Notification information	MRC
08/25/05	Figure 3.0	Updated External Notification information	MRC
11/08/05	Table J-1	Update Spill Response Equipment List	MRC
10/26/06	Entire Spill Plan	Name Change Update from Lyondell-Citgo to Lyondell Houston Refinery. Includes all text and drawings with reference to Lyondell Citgo and its logo.	MRC
06/05/07	Appendix D Tank Table	Deleted demolished tanks 135TK0598 and 135TK0599. Added new tanks 134TK0912 and 135TK0100	MRC
06/05/07	Table E-1	Added new tank 134TK0912	MRC
06/12/07	Figure 3.0(A)	Added GLO phone number to table.	JDL
08/31/07	Table 2-2	Corrected line descriptions	JDL
08/31/07	Table 2-3	Updated permit renewal dates.	JDL

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
08/31/07	Table 1-1	Updated Record of Revisions	JDL
09/25/07	2-3	Removed Section 2.2.4 referencing two USTs.	JDL
09/25/07	2-3	Added Section 2.2.4 referencing two ASTs for storing gasoline and diesel fuel.	JDL
09/25/07	Table 1-1	Updated Record of Revisions	JDL
09/26/07	3-1 thru 3-5	Updated format and replaced entire section.	JDL
09/26/07	Figure 3	Updated format and replaced table.	JDL
09/26/07	Figure 3.0(A)	Updated format, replaced External Notifications Reference table, and relabeled to Table 3-1.	JDL
09/26/07	4-1 thru 4-2	Updated format, revised text, and replaced pages.	JDL
09/26/07	Appendix J	Updated Figure for GLO staged equipment locations	JDL
09/27/07	5-1 thru 5-14	Updated format, revised text, and replaced pages.	JDL
09/27/07	6-1	Updated format, revised text, and replaced page.	JDL
09/28/07	Appendix D	Updated format and listing of Tank Failures: Supplement to the Storage Tank Summary Table	JDL
09/28/07	7-1 thru 7-2	Updated format, revised text, and replaced pages.	JDL
09/28/07	Appendix E	Updated Attachments 3 thru 30 with refinery name change and replaced pages.	JDL
09/28/07	Appendix E	Updated Emergency Management Training and Exercise Plan with refinery name change and replace pages.	JDL
09/28/07	8-1 thru 8-10	Updated format, revised text, and replaced pages.	JDL
09/28/07	Section 8	Updated Attachments 9, 10, 14-16, 26, and Table Top Exercise Documentation with refinery name change and replaced pages.	JDL
09/28/07	Appendix A	Updated 40 CFR 112 Appendix F cross-reference table and replaced page.	JDL
09/28/07	Appendix B	Updated Acronyms list and replaced page.	JDL
09/28/07	Appendix C	Updated Oils Handled page with refinery name change and replaced pages.	JDL
09/28/07	E-1 thru E-2	Updated Tanks With Tank Dikes As Secondary Containment section with refinery name change, revised text, and replaced pages.	JDL
09/28/07	Table E-1	Updated format and replaced table.	JDL
10/01/07	5-9	Deleted Section 5.3.2 <i>Non-Mechanical Treatment Options</i> and renumber remaining sections in 5.3	JDL
10/18/07	Table 1-1	Updated Record of Revisions	JDL
10/18/07	Plan	Completed annual review	JDL
08/15/08	Table 3-2	Updated external contact information for Wildlife Assistance and CCA	JDL

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
08/15/08	Table 1-1	Updated Record of Revisions	JDL
08/18/08	Table 5-2	Removed 430TK0869 from Tank Table (demolished for Degassing Unit)	JDL
08/18/08	Table 1-1	Updated Record of Revisions	JDL
08/19/08	Table E-1	Removed demolished tank 134TK0607 from table.	JDL
08/19/08	Table E-2	Removed demolished tanks 134TK0607, 136TK0598, and 136TK0599 from table, and added 136TK0100.	JDL
08/19/08	Plan	Completed annual review	JDL
07/01/09	Cover & Spline	Updated revision date	JDL
07/01/09	Inside Cover	Updated revision date	JDL
07/01/09	5-14	Updated contact name and numbers for US Fish & Wildlife Services.	JDL
07/01/09	Table 1-1	Updated Record of Revisions	JDL
07/01/09	Plan	Completed annual review	JDL
04/29/10	5.1.1	Added section on Secondary Spill Containment	JDL
04/29/10	Appendix E	Added section on Tank Dike Wall Valve Operation	JDL
06/07/10	Table 3-2	Updated External Notification phone numbers	JDL
06/08/10	5.14	Updated contact name and numbers for US Fish & Wildlife Services.	JDL
06/08/10	Table 1-1	Updated Record of Revisions	JDL
06/08/10	Plan	Completed annual review	JDL
06/09/11	5.14	Updated contact name and numbers for US Fish & Wildlife Services.	JDL
06/09/11	Table 1-1	Updated Record of Revisions	JDL
06/09/11	Plan	Completed annual review	JDL
11/02/11	Table 2-3	Updated new effective date of GCA Affluent Permit	JDL
11/02/11	Table 1-1	Updated Record of Revisions	JDL
06/26/12	Table 3-2	Changed name of "Wildlife Rehabilitation & Education" to "Wildlife Center of Texas"	JDL
06/26/12	5.6	Changed name of "Wildlife Rehabilitation & Education" to "Wildlife Center of Texas"	JDL
06/26/12	Cover & Spline	Updated revision date	JDL
06/26/12	Inside Cover	Updated revision date	JDL
06/26/12	Table 1-1	Updated Record of Revisions	JDL
07/30/12	2.1	Inserted hyperlinks to Figures 2-1 and 2-2 and revised section text.	JDL
07/30/12	2.1.3	Inserted hyperlinks to MSDSs, modified section text, and inserted Top Ten Oils table from Appendix C	JDL

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
07/30/12	3.7	Changed HSE Coordinator to Emergency Management Coordinator	JDL
07/30/12	3.7	Updated source of accurate weather information and location of weather station	JDL
07/30/12	8.1.1	Changed section title	JDL
07/30/12	8.1.2	Changed section title	JDL
07/30/12	8.1.4	Changed section title	JDL
08/24/12	3.8.3	Added new section for Evacuation and Personnel Evacuation and included hyperlinks to procedure and Evacuation Plan diagram.	JDL
08/29/12	Plan	Completed annual review and update to SRPP including reformat and restructure into a single web-based document for easy online access and navigation by use of hyperlinks.	JDL
02/22/13	Figure 1-1	3 rd Party Certification (Witt Obrien's) – Added Corrective Action Items.	JDL
02/22/13	Figure 1-2	3 rd Party Certification (Witt Obrien's) – Modified date of facility site visit.	JDL
02/22/13	Figure 1-5	3 rd Party Certification (Witt Obrien's) – Added reference to SPCC elements table.	JDL
02/22/13	Figure 1-6	3 rd Party Certification (Witt Obrien's) – Added new figure for Facility Information.	JDL
02/22/13	Figure 1-7	3 rd Party Certification (Witt Obrien's) – Added new figure for DOT PHMSA Operator's Statement of Significant and Substantial Harm	JDL
02/22/13	1.4	3 rd Party Certification (Witt Obrien's) – Added language that SPCC technical amendments, certification, and Plan revisions.	JDL
02/22/13	2.2.3	3 rd Party Certification (Witt Obrien's) – Added secondary containment systems checklist	JDL
02/22/13	2.2.3	3 rd Party Certification (Witt Obrien's) – Added statement about alternates requirement for qualified oil-filled operational equipment.	JDL
02/22/13	2.2.4	3 rd Party Certification (Witt Obrien's) – Added statement about buried or bunkered storage tanks.	JDL
02/22/13	Table 2-3	3 rd Party Certification (Witt Obrien's) – Added phone number for Weather Report.	JDL
02/22/13	Table 3-3	3 rd Party Certification (Witt Obrien's) – Added Notification Data Sheet.	JDL
02/22/13	3.6.1	3 rd Party Certification (Witt Obrien's) – Added statement about retention of inspection records on response equipment.	JDL

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
02/22/13	3.8.3	3 rd Party Certification (Witt Obrien's) – Added reference to EAP-003, Section 3.8.3.	JDL
02/22/13	4.1	3 rd Party Certification (Witt Obrien's) – Added statement about distance to navigable waterway.	JDL
02/22/13	5.5.1	3 rd Party Certification (Witt Obrien's) – Added list of immediate actions for spills on land	JDL
02/22/13	5.2.3	3 rd Party Certification (Witt Obrien's) – Added statement about distance to navigable waterway.	JDL
02/22/13	5.2.4	3 rd Party Certification (Witt Obrien's) – Added statement about distance to navigable waterway.	JDL
02/22/13	5.7	3 rd Party Certification (Witt Obrien's) – Added new section for Vulnerability Analysis.	JDL
02/22/13	7.1	3 rd Party Certification (Witt Obrien's) – Added new tank inspection checklist.	JDL
02/22/13	8.1.1	3 rd Party Certification (Witt Obrien's) – Added new bullets about prevention briefings for oil-handling personnel.	JDL
02/22/13	Figure 8-3	3 rd Party Certification (Witt Obrien's) – Added new figure for Inspector Qualification Matrix.	JDL
03/05/13	Figure 1-2	3 rd Party Certification (Witt Obrien's) – Added firm registration number.	JDL
03/08/13	1.1	Minor language modification	JDL
03/12/13	2.2.3	Complete rewrite of first 2 paragraphs to address the refinery containment philosophy, oil-filled operational equipment, and the May 2011 aerial survey	JDL
03/25/13	Figure 3-2	Complete revision of Emergency Operations Structure diagram.	JDL
03/28/13	Figure 1-3	Renumber to Figure 1-4 and updated references	JDL
03/28/13	Figure 1-4	Renumber to Figure 1-5 and updated references	JDL
03/28/13	Figure 1-5	Renumber to Figure 1-6 and updated references	JDL
03/28/13	Figure 1-6	Renumber to Figure 1-7 and updated references	JDL
03/28/13	Figure 1-7	Renumber to Figure 1-8 and updated references	JDL
03/28/13	Figure 1-3	Created new figure for Certification of the Applicability of Substantial Harm Criteria	JDL
03/29/13	Figure 1-2	3 rd Party Certification (Witt Obrien's) – Issued signed Engineer's Certification	JDL
04/10/13	2.2.3	Added referenced to Oil-Filled Electrical Equipment Table & Cathodic Protection Rectifier Location Plan	JDL
04/10/13	Table 2-7	Renumbered to Table 2-8 and updated references	JDL
04/10/13	Table 2-6	Renumbered to Table 2-7 and updated references	JDL
04/10/13	Table 2-5	Renumbered to Table 2-6 and updated references	JDL

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
04/10/13	Table 2-4	Renumbered to Table 2-5 and updated references	JDL
04/10/13	Table 2-4	Added new table for list of Oil-Filled Electrical Equipment and updated references	JDL
04/10/13	Figure 2-3	Renumbered to Figure 2-4 and updated references	JDL
04/10/13	Figure 2-4	Renumbered to Figure 2-5 and updated references	JDL
04/10/13	Figure 2-5	Renumbered to Figure 2-6 and updated references	JDL
04/10/13	Figure 2-6	Renumbered to Figure 2-7 and updated references	JDL
04/10/13	Figure 2-7	Renumbered to Figure 2-8 and updated references	JDL
04/10/13	Figure 2-8	Renumbered to Figure 2-9 and updated references	JDL
04/10/13	Figure 2-3a	Added new Cathodic Protection Rectifier Location Plan diagram	JDL
04/16/13	Figure 2-3b	Added new Contractor Oil Storage Location diagram	JDL
04/16/13	Plan	Completed annual review	JDL
04/17/13	Figure 1-3	Signed by Site Manager	JDL
04/17/13	Figure 1-3	Signed by Site Manager	JDL
04/17/13	Figure 1-4	Signed by Site Manager	JDL
04/17/13	Figure 1-5	Signed by Site Manager	JDL
04/17/13	Figure 1-6	Signed by Site Manager	JDL
04/17/13	Figure 1-8	Signed by Site Manager	JDL
04/23/13	Plan	Converted Plan to Adobe pdf document for transmittal to agencies.	JDL
05/01/13	Figure 1-1	Signed by Site Manager after completion of all Plan Implementation Requirements	JDL
06/10/13	Table 5.5	Renumbered to Table 5-6 and updated references	JDL
06/10/13	Table 5.4	Renumbered to Table 5-5 and updated references	JDL
06/10/13	Table 5.4	Add new table for Waste Transporters and Disposal Facilities and updated references	JDL
06/10/13	ERAP	Added HSE-ENV-610 - On-Site Waste Activities	JDL
06/11/13	5.4.2	Added reference to HSE-ENV-610 procedure	JDL
06/11/13	5.4.3	Added reference to new Table 5-4	JDL
06/11/13	3.3.2	Added language related to dispersant application and aerial observation requirements.	JDL
06/12/13	4.1	Added language to address 4 breakout tanks in STF	JDL
06/12/13	Table 2-8	Added note at bottom of table to address uses of chemical agents and in-situ burning.	JDL
06/13/13	4.5	Added new section to address discharge characteristics from equipment failure.	JDL
06/13/13	2.6.1	Added sentence about loading railcar/tank truck loading rack containment area.	JDL

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
06/13/13	1.4	Added sentence indicating Plan will be submitted electronically to DOT every 5 years.	JDL
06/13/13	5.7	Expanded section on vulnerability analysis and updated references.	JDL
06/13/13	Figure 3-9	Replaced TxGLO Staged Equipment diagram with current illustration.	JDL
06/13/13	Figure 5-1	Replaced Environmentally Sensitive Impact Areas with current TxGLO maps.	JDL
06/13/13	Table 1-1	Updated Regulatory Cross Reference Table.	JDL
06/14/13	Table 1-3	Updated Record of Revisions.	JDL
08/20/13	Table 3-2	Added phone numbers for USCG Sector Houston – Galveston and EPA Region 6 Spill Line	JDL
08/20/13	Table 4-2	Renamed to Table 4-3	JDL
08/20/13	Table 5-1	Renamed to Table 4-2, changed table title, and revised heading.	JDL
08/21/13	Table 5-2	Renamed to Table 5-1	JDL
08/21/13	Table 5-3	Renamed to Table 5-2	JDL
08/21/13	Table 5-4	Renamed to Table 5-3	JDL
08/21/13	Table 5-5	Renamed to Table 5-4	JDL
08/21/13	Table 5-6	Renamed to Table 5-5	JDL
08/22/13	4.1	Revised section to clarify EPA, DOT, and USCG worst-case calculations.	JDL
08/22/13	5.1	Removed reference to Table 5-1	JDL
08/22/13	Figure 3-2	Updated diagram to identify Finance Section under Logistics Section Chief	JDL
08/22/13	3.3.4	Added new Logistics section to describe Finance Section in HRO's IC Structure.	JDL
08/22/13	Table 2-1	Added footnotes and references	JDL
08/23/13	Figure 1-7	Added Facility-Specific Information paragraph	JDL
08/23/13	TOC	Updated Table of Contents	JDL
08/23/13	TOC	Updated List of Tables	JDL
08/23/13	Table 1-3	Updated Record of Revisions.	JDL
10/01/13	Table 2-1	Removed demolished 887 Tank from table.	JDL
10/09/13	Table 2-8	Renamed and updated	RFG
10/09/13	2.10	Minor language modification	RFG
10/09/13	List of Tables	Updated Table 2-8 title	RFG
10/09/13	2.2.1	Revised number of storage tanks	RFG
10/09/13	5.4.2	Minor language modification	RFG
02/17/14	2.2.3	Minor language modification for drawing oil from tank	RFG

Table 1-3 Record of Revisions

Date	Section or Page	Change	Initials
02/18/14	1.4	Changed language to state Plan will be submitted to DOT every 5-years from submittal date	RFG
02/18/14	Table 3-1	Updated phone number for Alternate QI	RFG
02/18/14	8.1.1	Revised language to state SRPP training records as long are maintained as personnel are assigned duties under the SRPP	RFG
02/18/14	8.1.2	Revised language to state HAZWOPER training records are maintained as long as personnel are assigned duties under the SRPP	RFG
02/18/14	8.1.4	Revised language to state Spill Response Team training records are maintained as long as personnel are assigned duties under the SRPP	RFG
02/18/14	8.2.4	Revised language to state Marine Spill Team training records are maintained as long as personnel are assigned duties under the SRPP	RFG
02/19/14	4.1	Updated USCG worst-case discharge to include length of #1 Crude line at docks	RFG
02/19/14	4.1	Updated DOT worst-case pipeline discharge to include length of 36" crude line	RFG
02/19/14	4.1	Added statement indicating DOT worst-case pipeline discharge is based on best engineering judgment	RFG
02/19/14	4.4	Update year to include 2013 tank failures	RFG
02/19/14	Table 4-3	Updated table to include 2013 tank failures	RFG

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
035TK1901	Diesel Fuel	Horizontal	----	(b) (7)(F), (b) (3)		
035TK1902	Diesel Fuel	Horizontal	----			
035TK1903	Diesel Fuel	Horizontal	----			
035TK1904	Diesel Fuel	Horizontal	----			
133TK0876	Kerosene/Diesel	IFR	1980			
133TK0878	Kerosene/Diesel	IFR	1974			
133TK0879	Kerosene/Diesel	IFR	1974			
133TK0880*	Xylene Reform Feed/OP400/Condensate	IFR	1974			
133TK0881	Kerosene/Diesel	IFR	1974			
133TK0882*	OP400/Condensate/LCO	IFR	1974			
133TK0883	Crude	IFR	1974			
133TK0884	Diesel/LCO/OP400/Condensate	IFR	1974			
133TK0885*	Crude	EFR	1975			
133TK0886*	Crude	EFR	1975			
133TK0887	Crude	EFR	1975			
133TK0890*	Crude	EFR	2004			
133TK0894	Rust Inhibitor Diesel Additive	VFR-Cone	1978			
133TK0896	Pour Depressant Diesel Additive	VFR-Cone	1978			
133TK0897	Diesel Fuel	VFR-Cone	1978			
133TK0898	Cetane Improver Diesel Additive	VFR-Cone	1978			
134TK0011*	Xylene Reform Feed	EFR	1971			
134TK0012*	CBO/HGO/VGO/Resid	VFR-Cone (Insulated)	1977			
134TK0017	Crude	EFR (Insulated)	1966			
134TK0601*	CBO/HGO/Resid	VFR-Cone (Stm Heated)	1921			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
134TK0604	CBO/HGO/Resid	VFR-Cone (Insulated)	1938	(b) (7)(F), (b) (3)		
134TK0609	Heating Oil/Kerosene	VFR-Cone	1965			
134TK0613*	Coker Naphtha/OP 400/Condensate/Reformer Feed	IFR	1975			
134TK0618	Coker Naphtha/OP 400/Condensate/Reformer Feed	EFR	1943			
134TK0619	Coker Naphtha/OP 400/Condensate/Reformer Feed	EFR	1968			
134TK0622*	Coker Naphtha/OP 400/Condensate/Reformer Feed	Spheroid	1953			
134TK0623*	Coker Naphtha/OP 400/Condensate/Reformer Feed	Spheroid	1952			
134TK0624*	Coker Naphtha/OP 400/Condensate/Reformer Feed	Spheroid	1952			
134TK0625	Coker Naphtha/OP 400/Condensate/Reformer Feed	Spheroid	1952			
134TK0626	Coker Naphtha/OP 400/Condensate/Reformer Feed	Spheroid	1953			
134TK0627*	Coker Naphtha/OP 400/Condensate/Reformer Feed	Spheroid	1953			
134TK0642	Butane/Butylene	Spheroid	1956			
134TK0643	Butane/Butylene	Spheroid	1956			
134TK0688	ISOM 2 Feed/Mixed Xylenes	IFR	1967			
134TK0774	Crude	EFR	1958			
134TK0775*	Crude	EFR	1958			
134TK0776	Crude	EFR	1960			
134TK0777*	Crude	EFR	1960			
134TK0801*	HS Coker Feed/HGO/CBO	VFR-Cone	1962			
134TK0802*	Crude	EFR	1962			
134TK0813*	HS Coker Feed/HGO/CBO	VFR-Cone	1968			
134TK0814*	HS Coker Feed/HGO/CBO	VFR-Cone	1968			
134TK0830	Normal Butane	Spheroid	1964			
134TK0831	C5 Raffinate	Spheroid	1967			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
134TK0832	Pentane	Spheroid	1967	(b) (7)(F), (b) (3)		
134TK0833	Pentane	Spheroid	1967			
134TK0850*	Xylene Reformer Feed	EFR	1971			
134TK0867	Heating Oil/Kerosene	IFR	1975			
134TK0891*	HGO/VGO	VFR-Cone	1977			
134TK0911	Resid/Coker Feed	VFR-Cone	1970			
134TK0912*	HGO	VFR-Cone	2006			
135TK0560	Gasoline	EFR	1934			
135TK0561	Gasoline	EFR	1934			
135TK0562	Gasoline	EFR	1934			
135TK0563	Gasoline	EFR	1934			
135TK0564	Gasoline	EFR	1934			
135TK0565	Gasoline	EFR	1979			
135TK0570*	Alkylate	EFR	1934			
135TK0571*	Kerosene/Jet Fuel	VFR-Cone	1937			
135TK0572*	Kerosene	VFR-Cone	1937			
135TK0573*	Kerosene/Jet Fuel	EFR	1943			
135TK0574	VGO	VFR-Cone	1943			
135TK0576*	Reformer Feed/Gasoline Blending Stock	EFR	1956			
135TK0577	Gasoline Blending Stocks	EFR	1956			
135TK0578	Fluid Gasoline	EFR	1958			
135TK0579*	Light Py Gasoline/Gasoline Blending Stocks	EFR	1958			
135TK0806	Gasoline	EFR	1963			
135TK0807	Light Fluid Gasoline	EFR	1964			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
135TK0808	Gasoline	EFR	1964	(b) (7)(F), (b) (3)		
135TK0809	Gasoline	EFR	1964			
135TK0836	Rust Inhibitor Additive	VFR-Cone	1968			
135TK0841	Gasoline Additive	VFR-Cone	1968			
135TK0842	Gasoline Additive	VFR-Cone	1968			
136TK0030	Light Pyro Gasoline/BT Reformer Feed	IFR	1975			
136TK0100	Kerosene	EFR	2007			
136TK0441	Toluene	EFR	1943			
136TK0442	Toluene	EFR	1943			
136TK0558	Crude/Slop Oil	EFR	1955			
136TK0559	Crude	EFR	1955			
136TK0582*	VGO	EFR	1954			
136TK0583*	Crude/Slop Oil/VGO	EFR	1954			
136TK0584	Crude/Slop Oil	EFR	1954			
136TK0590	Sulfidic Caustic	EFR	1944			
136TK0591	Sulfidic Caustic	EFR	1944			
136TK0594*	VGO	EFR	1953			
136TK0597	VGO	EFR	1977			
136TK0600	Xylene Reform Feed	EFR	1956			
136TK0674	Light Pyro Gasoline/BT Reformer Feed	EFR	1966			
137TK0402	Sulfidic Caustic	EFR	1993			
137TK0412	Pretreatment Recovered Slop Oil	IFR	1964			
137TK0414*	Gasoline Blending Stocks	EFR	1954			
137TK0416*	Heavy Py Gasoline/Gasoline Blending Stocks	EFR	1954			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
137TK0418*	Heavy Py Gasoline/Gasoline Blending Stocks	EFR	1954	(b) (7)(F), (b) (3)		
137TK0420	Light Reclaimed Oil	EFR	1966			
137TK0422	Light Reclaimed Oil	VFR-Cone	1971			
137TK0423	Light Reclaimed Slop Oil	EFR	1954			
137TK0424	Raffinate	EFR	1966			
137TK0425	Light Reclaimed Slop Oil	EFR	1954			
137TK0445	Caustic	VFR-Cone	1931			
137TK0446	Caustic	VFR-Cone	1931			
137TK0468	Caustic	VFR-Cone	1950			
137TK0509	Caustic	VFR-Cone	1927			
137TK0553	Mixed Xylenes	VFR-Cone	1958			
137TK0554	Toluene	EFR	1958			
137TK0555	Toluene	EFR	1958			
137TK0557	Toluene	EFR	1958			
137TK0580	Orthoxylene	EFR (Stm Heated)	1960			
137TK0581	Mixed Xylenes	EFR	1960			
137TK0667*	Benzene	IFR (Stm Heated)	1966			
137TK0668*	Benzene	IFR (Stm Heated)	1966			
137TK0687*	Paraxylene	IFR (Stm Heated)	1967			
137TK0691	Mixed Xylenes	IFR	1966			
137TK0692*	Toluene	IFR	1966			
137TK0793	Toluene	EFR	1958			
137TK0794	Toluene	EFR	1959			
137TK0797	Crystallizer Feed/Paraxylene	EFR	1961			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
137TK0798	Orthoxylene	EFR	1961	(b) (7)(F), (b) (3)		
137TK0799	Orthoxylene	EFR	1961			
137TK0800	Ortho 1 Feed/Mixed Xylenes	EFR	1961			
137TK0803	Light Reclaimed Slop Oil	EFR	1962			
137TK0804	Light Reclaimed Slop Oil	EFR	1962			
137TK0805	Toluene/Aromatics Concentrate	EFR	1962			
137TK0815	Coker Naphtha	IFR	1968			
137TK0821	Mixed Xylenes	IFR	1964			
137TK0822	Toluene	IFR	1964			
137TK0861	Paraxylene	IFR	1973			
137TK0865*	Benzene Extract	IFR	1979			
137TK0873*	Light Py Gasoline/Gasoline Blending Stocks	IFR	1978			
137TK0874	Toluene	IFR	1975			
137TK0875	Benzene	IFR (Stm Heated)	1975			
137TK0920	Heavy Py Gasoline/Gasoline Blending Stocks	IFR	1995			
138TK0006*	Grade A Crude	EFR	1966			
138TK0026	Pale Oil	EFR (Stm Heated)	1972			
138TK0027*	Pale Oil	VFR-Cone	1970			
138TK0091	Pale Oil	VFR-Cone	1920			
138TK0092*	Pale Oil	VFR-Cone	2003			
138TK0093	Pale Oil	VFR-Cone	1920			
138TK0095	Pale Oil	VFR-Cone	2012			
138TK0096	Pale Oil	VFR-Cone	2003			
138TK0097	White Oil	VFR-Cone	1920			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
138TK0098	White Oil	VFR-Cone	1942	(b) (7)(F), (b) (3)		
138TK0099	White Oil	VFR-Cone	1942			
138TK0111	Pale Oil	VFR-Cone	1940			
138TK0114	Untreated Heavy Lube Distillate	VFR-Cone	1940			
138TK0116	Solvent Neutral	VFR-Cone	1940			
138TK0117	Solvent Neutral	VFR-Cone	1940			
138TK0118	Solvent Neutral	VFR-Cone	1942			
138TK0119	Solvent Neutral	VFR-Cone	1942			
138TK0164*	Solvent Neutral	VFR-Cone	1940			
138TK0165*	Heavy Lube Distillate	VFR-Cone	1940			
138TK0166*	Solvent Neutral	VFR-Cone	1940			
138TK0167	Solvent Neutral	VFR-Cone	1940			
138TK0168	Solvent Neutral	VFR-Cone	1940			
138TK0180	Pale Oil	VFR-Cone	1920			
138TK0181	Untreated Heavy Lube Distillate	VFR-Cone	1920			
138TK0182	Untreated Heavy Lube Distillate	VFR-Cone	1920			
138TK0183*	Solvent Neutral	VFR-Cone	1920			
138TK0193	Tufflo 425	VFR-Cone	1922			
138TK0194*	Solvent Neutral	VFR-Cone	1922			
138TK0195	Pale Oil	VFR-Cone	1922			
138TK0200	Pale Oil	VFR-Cone	1921			
138TK0201	Pale Oil	VFR-Cone	1921			
138TK0202	Pale Oil	VFR-Cone	1921			
138TK0203	Pale Oil	VFR-Cone	1921			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
138TK0204	Pale Oil	VFR-Cone	1921	(b) (7)(F), (b) (3)		
138TK0244*	DHN Feed	VFR-Cone	1942			
138TK0271	Untreated Heavy Lube Distillate	VFR-Cone	1942			
138TK0272	Untreated Heavy Lube Distillate	VFR-Cone	1942			
138TK0273	Slop Oil	VFR-Cone	1942			
138TK0274*	DHN Feed	VFR-Cone	1942			
138TK0275	Pale Oil	VFR-Cone	1942			
138TK0276	Pale Oil	VFR-Cone	1942			
138TK0649	Heavy Lube Distillate	VFR-Cone	1961			
138TK0650	Heavy Lube Distillate	VFR-Cone	1961			
138TK0651	Heavy Lube Distillate	VFR-Cone	1961			
138TK0652	Heavy Lube Distillate	VFR-Cone	1961			
138TK0653	Heavy Lube Distillate	VFR-Cone	1961			
138TK0659	White Oil	VFR-Cone	1965			
138TK0660	White Oil	VFR-Cone	1965			
138TK0661	White Oil	VFR-Cone	1965			
138TK0662	White Oil	VFR-Cone	1965			
138TK0663	White Oil	VFR-Cone	1965			
138TK0664	White Oil	VFR-Cone	1965			
138TK0665	White Oil	VFR-Cone	1965			
138TK0666	White Oil	VFR-Cone	1965			
138TK0726*	DHN Feed	VFR-Cone	1950			
138TK0729*	DHN Feed	VFR-Cone	1947			
138TK0732	White Oil Slop	VFR-Cone	1948			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
138TK0767*	DHN Feed	VFR-Cone	1956	(b) (7)(F), (b) (3)		
138TK0768*	Pale Oil	VFR-Cone	1956			
138TK0769	White Oil	VFR-Cone	1956			
138TK0771	White Oil	VFR-Cone	1956			
138TK0772	White Oil	VFR-Cone	1956			
138TK0812*	Solvent Neutral	VFR-Cone	1967			
138TK0851	Pale Oil	VFR-Cone	1971			
138TK0856	Pale Oil	VFR-Cone	1972			
138TK0857	Pale Oil	VFR-Cone	1972			
138TK0862	Pale Oil	VFR-Cone	1973			
138TK0863	Pale Oil	VFR-Cone	1981			
138TK0892*	Grade "A" Crude	EFR	1977			
138TK0893*	Grade "A" Crude	EFR	1977			
138TK7601	White Oil	VFR-Cone	1955			
233TK0430	Normal Butane	Spheroid	1943			
335TK0069	Condensate	VFR-Cone	1943			
335TK0647	Demineralized Water	VFR-Cone	1953			
336TK0744	Condensate	VFR-Cone	1952			
338TK0586	Drips	Spheroid	1944			
338TK0587	Drips	Spheroid	1944			
430TK0001	Lean DEA	VFR-Cone	1970			
430TK0817	Lean Recirculation DEA	VFR-Cone	1968			
430TK0870*	Molten Sulfur	VFR-Cone (Stm-Heated)	1997			
430TK0871*	Molten Sulfur	VFR-Cone (Stm-Heated)	1975			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
430TK0872	MDEA	IFR	1975	(b) (7)(F), (b) (3)		
430TK4001	Sour Water	IFR	1996			
430TK4002	Sour Water	IFR	1996			
432TK0810	Wastewater Diversion	EFR	1966			
432TK0811	Wastewater Diversion	EFR	1966			
432TK0818	Light Reclaimed Slop Oil	EFR	1969			
432TK0819	Light Reclaimed Slop Oil	EFR	1969			
432TK0835	Process & SW Wastewater	EFR	1993			
432TK0838	Process & SW Wastewater	EFR	1994			
432TK0854	Benzene NESHAP Wastewater Feed	IFR	1971			
432TK0855	Benzene NESHAP Wastewater Feed	IFR	1971			
632TK0585	Coker Naphtha	Spheroid	1944			
732TK0032	Caustic	VFR-Cone	1992			
732TK0064	Clarifier	VFR-Cone	1992			
732TK0066	Thickener	VFR-Cone	1992			
734TK0671	Fresh Sulfolane Make-up Solvent	VFR-Cone	1966			
734TK0672	Slop Sulfolane Solvent	IFR	1966			
734TK0673	Sulfolane Extraction Section Blowdown	IFR	1966			
736TK0101	Jet	EFR	1968			
736TK0150	Diesel Fuel	Horizontal	----			
736TK0923	Slurry Feed	VFR	1986			
736TK1101	Water Clarifier	VFR-Open	1968			
737TK0001	Decoking Water	VFR-Open	1995			
833TK0654	1 st Stage Off Test	VFR-Cone	1965			
833TK0655	1 st Stage Off Test	VFR-Cone	1965			

Table 2-1 Tank Capacities

Function Location Number	Material Stored	Container Design**	Year Built	Shell Capacity (bbls)	Max Fil Capacity (bbls)	Average Capacity (bbls)
833TK0656	2 nd Stage Off Test	VFR-Cone	1965	(b) (7)(F), (b) (3)		
833TK0657	2 nd Stage Off Test	VFR-Cone	1965			
833TK0658	Heavy Lube Distillate	VFR-Cone	1965			
930TK0784	DGA	VFR-Cone	1958			
930TK0786	DGA	VFR-Cone	1958			
930TK0787	DGA	VFR-Cone	1958			
933TK0689	Benzene	IFR	1967			
933TK0690	Benzene	IFR	1967			
934TK0685	Orthoxylene	IFR	1967			
934TK0686	Orthoxylene	IFR	1967			
935TK0790	Crystallizer Feed/Paraxylene	EFR-Heated	1958			
935TK0792	Xylene Slop	VFR-Cone-Heated	1958			
939TK0693	Paraxylene	IFR	1966			
939TK0694	Paraxylene	IFR	1966			
940TK0669	Benzene	IFR	1966			
940TK0670	Benzene	IFR	1966			
940TK0795	Toluene	EFR	1961			
940TK0796	Toluene	EFR	1961			

* Indicates tanks used in marine transfer operations to/from barges and cargo ships. Only B-Dock and C-Dock are capable of loading/unloading cargo ships whereas all four docks are capable of loading/unloading barges. D-Dock is dedicated to only loading molten sulfur.

** Container Design Reference:
EFR – External Floating Roof Tank
IFR – Internal Floating Roof Tank
VFR – Vertical Fixed Roof Tank

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
130-TR-021-4101	TRANSFORMER	130 HEAVY OIL TANK FARM	307
# 59 (GLOBAL, 230V, 1 PHASE)	RECTIFIER	130 LOADING RACK	12
# 03 (ADAIR, 460V, 3 PHASE)	RECTIFIER	133 - 225 TANK FARM	55
# 04 (ADAIR, 460V, 3 PHASE)	RECTIFIER	133 - 225 TANK FARM	55
# 05 (ADAIR, 460V, 3 PHASE)	RECTIFIER	133 - 225 TANK FARM	55
#01 (ADAIR, 460V, 3 PHASE)	RECTIFIER	133 - 225 TANK FARM	55
#02 (ADAIR, 460V, 3 PHASE)	RECTIFIER	133 - 225 TANK FARM	55
133-TR-032-4131	TRANSFORMER	133 - 225 TANK FARM	370
133-TR-032-5131	TRANSFORMER	133 - 225 TANK FARM	1,054
134P0106	BREAKER	134 10" CRUDE FEED PUMP	107
134P0107	BREAKER	134 6" CRUDE FEED PUMP	217
134P0116	BREAKER	134 AVIATION PUMP	144
134P0117	BREAKER	134 AVIATION PUMP	107
134-TR-081-4146	TRANSFORMER	134 LYONDELL TRANSFER PUMPS STATION	55
134-TR-081-41411	TRANSFORMER	134 SW OF CENTRAL SHOPS	170
# 16 (UNIVERSAL, 440V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	110
# 17 (UNIVERSAL, 440V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	110
# 18 (UNIVERSAL, 440V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	110
# 21 (ADAIR, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	65
# 22 (UNIVERSAL, 440V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	110
# 23 (RIO, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	60
# 24 (GOODALL, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	50
# 25 (BRANCE KRACHY, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	60
# 26 (RIO, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	60
# 27 (RIO, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	60
# 33 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	54
# 75 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	134 WEST TANK FARM	110
134-TR-042-4143	TRANSFORMER	134 WEST TANK FARM	101

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
134-TR-081-4149	TRANSFORMER	134 WEST TANK FARM (#6 FUEL OIL SLAB)	150
134-TR-081-4148	TRANSFORMER	134 WEST TANK FARM (NORTH OF SUB #8)	126
134-TR-013-4144	TRANSFORMER	134 WEST TANK FARM, 774 TANK	200
134-TR-013-4145	TRANSFORMER	134 WEST TANK FARM, 776 TANK	250
135-TR-042-4157	TRANSFORMER	135 ALLENDALE TANK FARM	215
132-TR-043-4121	TRANSFORMER	135 BLENDER OFFICE	115
# 06 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 07 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 08 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 09 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 10 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 11 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 12 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 13 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 14 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 15 (RIO, 440V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	60
# 72 (UNIVERSAL, 230V, 3 PHASE)	RECTIFIER	135 SOUTH TANK FARM	112
135-TR-041-4151	TRANSFORMER	135 SOUTH TANK FARM	268
135-TR-042-4156	TRANSFORMER	135 SOUTH TANK FARM	101
135-TR-042-4156A	TRANSFORMER	135 SOUTH TANK FARM	60
135-TR-042-4156B	TRANSFORMER	135 SOUTH TANK FARM	60
135-TR-042-4156C	TRANSFORMER	135 SOUTH TANK FARM	60
135-TR-043-4135A	TRANSFORMER	135 SOUTH TANK FARM	95
135-TR-043-4153	TRANSFORMER	135 SOUTH TANK FARM	247
135-TR-043-4153A	TRANSFORMER	135 SOUTH TANK FARM	N/A
135-TR-043-4153B	TRANSFORMER	135 SOUTH TANK FARM	N/A
135-TR-043-4153C	TRANSFORMER	135 SOUTH TANK FARM	N/A
# 19 (UNIVERSAL, 440V, 3 PHASE)	RECTIFIER	136 EAST TANK FARM	110

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
# 20 (UNIVERSAL, 440V, 3 PHASE)	RECTIFIER	136 EAST TANK FARM	110
# 29 (UNIVERSAL, 440V, 3 PHASE)	RECTIFIER	136 EAST TANK FARM	105
# 34 (ADAIR, 480V, 3 PHASE)	RECTIFIER	136 EAST TANK FARM	52
136-TR-051-4161	TRANSFORMER	136 EAST TANK FARM @ 136TK0100	150
136P0036	BREAKER	136 MOTOR STARTER	144
136P0037	BREAKER	136 MOTOR STARTER	222
137-TR-063-4173A	TRANSFORMER	137 ARU YARD PUMPS	40
137-TR-063-4173B	TRANSFORMER	137 ARU YARD PUMPS	40
137-TR-063-4173C	TRANSFORMER	137 ARU YARD PUMPS	40
137-TR-012-4172A	TRANSFORMER	137 AUSTIN HILL	38
137-TR-012-4172B	TRANSFORMER	137 AUSTIN HILL	38
137-TR-012-4172C	TRANSFORMER	137 AUSTIN HILL	38
137-TR-012-3171	TRANSFORMER	137 AUSTIN HILL LTG.	60
# 30 (RIO, 460V, 3 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	60
# 31 (GOODALL, 460V, 3 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	35
# 32 (GOODALL, 460V, 3 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	52
# 35 (RIO, 440V, 3 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	70
# 36 (RIO, 440V, 3 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	70
# 37 (RIO, 460V, 3 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	109
# 41 (GLOBAL, 230V, 1 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	16
# 42 (GLOBAL, 230V, 1 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	16
# 43 (GLOBAL, 230V, 1 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	49
# 70 (B / K, 460V, 0 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	62
# 71 (UNIVERSAL, 480V, 3 PHASE)	RECTIFIER	137 CENTRAL TANK FARM	49
137-TR-012-4171	TRANSFORMER	137 CENTRAL TANK FARM	150
137-TR-013-31711	TRANSFORMER	137 CRUDE TURNAROUND BLDGS.	135
137-TR-011-41711	TRANSFORMER	137 DEHAZER	294
137P0645B	BREAKER	137 DRIPOLINE PUMP	107

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
137-TR-013-4175	TRANSFORMER	137 PROCESS SOLUTIONS SLOP & SLUDGE UNIT	362
# 44 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	49
# 45 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	49
# 47 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	49
# 48 (UNIVERSAL, 480V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	49
# 55 (GLOBAL, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	16
# 56 (GLOBAL, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	53
# 57 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	53
# 58 (RIO, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	60
# 63 (GLOBAL, 460V, 3 PHASE)	RECTIFIER	138 HEAVY OIL TANK FARM	18
NONE	TRANSFORMER	138 MEK	20
NONE	TRANSFORMER	138 MEK CT	157
138-TR-014-4181A	TRANSFORMER	138 PHENOL COOLING TOWER	89
138-TR-014-4181B	TRANSFORMER	138 PHENOL COOLING TOWER	89
138-TR-014-4181C	TRANSFORMER	138 PHENOL COOLING TOWER	89
136-TR-011-3163	TRANSFORMER	138 WAX PLANT	20
136-TR-011-4161	TRANSFORMER	138 WAX PLANT	220
# 46 (UNIVERSAL, 460V, 3 PHASE)	RECTIFIER	139 DOCK-A	49
# 49 (RIO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-B	207
# 50 (RIO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-B	207
# 60 (RIO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-B	112
# 61 (B / K, 440V, 3 PHASE)	RECTIFIER	139 DOCK-B	69
# 62 (RIO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-C	207
# 65 (RIO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-C	112
# 66 (CORRPRO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-D	261
# 67 (CORRPRO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-D	60
# 68 (CORRPRO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-D	234
# 69 (CORRPRO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-D	60

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
# 73 (CORRPRO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-D	234
# 74 (RIO, 460V, 3 PHASE)	RECTIFIER	139 DOCK-D	210
139-TR-012-4194	TRANSFORMER	139 MARINE VAPOR RECOVERY	183
139-TR-013-4193	TRANSFORMER	139 MARINE VAPOR RECOVERY	183
230-TR-071-4201	TRANSFORMER	230 SUB 712 (230 GP)	222
230-TR-072-4202	TRANSFORMER	230 SUB 712 (230 GP)	222
# 28 (GOODALL, 460V, 3 PHASE)	RECTIFIER	231 LPG	52
231-TR-052-4211	TRANSFORMER	231 LPG FOS	226
231-TR-052-4212	TRANSFORMER	231 SUB 312 (NORTH) (633 H2 HEATERS)	198
234-TR-061-4242	TRANSFORMER	233 BRU	275
233-TR-062-4231	TRANSFORMER	233 BRU #2 DEPROP	225
233-TR-041-4232	TRANSFORMER	233 BRU COOLING TOWER (SUBSTATION #4)	190
234-TR-062-4241	TRANSFORMER	234 BLACK LAKE - NORTH	210
236-TR-072-4262	TRANSFORMER	236 GTR UNIT (CENTER)	224
236-TR-073-4261	TRANSFORMER	236 GTR UNIT (NORTH)	224
236-TR-072-6264	TRANSFORMER	236 GTR UNIT (SOUTH)	459
236-TR-002-7265	TRANSFORMER	236 SUBSTATION #7 (NORTH)	2,420
236-TR-002-7265(spare)	TRANSFORMER	236 SUBSTATION #7 (NORTH)	2,249
NONE	TRANSFORMER	246 - EAST OF 439 SRC	205
NONE	TRANSFORMER	246 - EAST OF 439 SRC	440
246-TR-042-3162	TRANSFORMER	246 ADMIN ANNEX TRAILERS	125
246-TR-041-4176	TRANSFORMER	246 BEHIND MEDICAL	165
246-TR-042-41712	TRANSFORMER	246 BEHIND MEDICAL	150
246-TR-013-3184	TRANSFORMER	246 BY 439 SRU CT	50
246-TR-000-8001	TRANSFORMER	246 KV SUBSTATION (NORTH)	9,918
246-TR-000-8002	TRANSFORMER	246 KV SUBSTATION (SOUTH)	9,918
246-TR-022-4265	TRANSFORMER	246 MERIT FAB SHOP	126
246-TR-012-41712A	TRANSFORMER	246 MUNDY LAYDOWN	69

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
246-TR-012-41712B	TRANSFORMER	246 MUNDY LAYDOWN	65
246-TR-001-5013	TRANSFORMER	246 SUBSTATION #1 (NORTH CENTER)	870
246-TR-002-5014	TRANSFORMER	246 SUBSTATION #1 (NORTH)	870
246-TR-002-5012	TRANSFORMER	246 SUBSTATION #1 (SOUTH CENTER)	870
246-TR-001-5011	TRANSFORMER	246 SUBSTATION #1 (SOUTH)	870
246-TR-002-5022	TRANSFORMER	246 SUBSTATION #2 (EAST)	746
246-TR-001-5021	TRANSFORMER	246 SUBSTATION #2 (WEST)	980
246-TR-001-7031	TRANSFORMER	246 SUBSTATION #3 (CENTER)	2,500
246-TR-001-7032	TRANSFORMER	246 SUBSTATION #3 (EAST)	2,500
246-TR-692-5042	TRANSFORMER	246 SUBSTATION #4	870
246-TR-693-5041	TRANSFORMER	246 SUBSTATION #4	870
246-TR-693-5043	TRANSFORMER	246 SUBSTATION #4	870
246-TR-692-5052	TRANSFORMER	246 SUBSTATION #5 (CENTER)	1,422
246-TR-072-5054	TRANSFORMER	246 SUBSTATION #5 (EAST)	1,125
246-TR-692-5053	TRANSFORMER	246 SUBSTATION #5 (NORTH)	1,422
246-TR-694-5051	TRANSFORMER	246 SUBSTATION #5 (SOUTH)	1,422
246-TR-073-5055	TRANSFORMER	246 SUBSTATION #5 (WEST)	1,125
246-TR-691-5061	TRANSFORMER	246 SUBSTATION #6	1,373
246-TR-691-5062	TRANSFORMER	246 SUBSTATION #6	1,373
246-TR-693-5063	TRANSFORMER	246 SUBSTATION #6	1,373
246-TR-002-7072	TRANSFORMER	246 SUBSTATION #7 (CENTER)	4,160
246-TR-002-7073	TRANSFORMER	246 SUBSTATION #7 (EAST)	4,657
246-TR-002-7071	TRANSFORMER	246 SUBSTATION #7 (WEST)	4,160
246-TR-032-5081	TRANSFORMER	246 SUBSTATION #8	1,280
246-TR-002-5092	TRANSFORMER	246 SUBSTATION #9 (EAST)	1,015
246-TR-001-5091	TRANSFORMER	246 SUBSTATION #9 (WEST)	1,015
246-TR-001-7693	TRANSFORMER	246 SUBSTATION 69 XFMR "A" (EAST CENTER)	5,000
246-TR-002-7692	TRANSFORMER	246 SUBSTATION 69 XFMR "B" (WEST CENTER)	5,000

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
246-TR-001-7694	TRANSFORMER	246 SUBSTATION 69 XFMR "D" (EAST)	3,430
246-TR-002-7691	TRANSFORMER	246 SUBSTATION 69, XFMR "C" (WEST)	5,000
246-TR-014-4187	TRANSFORMER	246 WEST SIDE OF NMP (PHENOL) @ P-46	90
331P0009	BREAKER	331 # 9 WATER WELL	234
333-TR-011-4331	TRANSFORMER	333 BOILER HOUSE	265
334-TR-013-4341	TRANSFORMER	334 BOILER HOUSE WATER TREATING #1	190
335-TR-011-4351	TRANSFORMER	335 CLARIFIER	190
336-TR-011-4361	TRANSFORMER	336 AIR COMPRESSOR SUB	95
None	TRANSFORMER	336 MAINT, PARKING	105
364-TR-081-4343	TRANSFORMER	336 MAINT, POLE YARD	350
338-TR-011-4381	TRANSFORMER	338 HOUSTON ST. FLARE (POWER POINT #3)	200
342-TR-012-4321	TRANSFORMER	342 NEW WATER TREATING	220
343-TR-091-4331	TRANSFORMER	343 ARU COOLING TOWER (SUBSTATION #9)	100
343-TR-092-4332	TRANSFORMER	343 ARU COOLING TOWER (SUBSTATION #9)	110
364-TR-081-4341	TRANSFORMER	364 TRAINING AREA (NORTH)	152
364-TR-081-4342	TRANSFORMER	364 TRAINING AREA (SOUTH)	330
430-TR-012-4414A	TRANSFORMER	430 OLD SULFUR CT	50
430-TR-012-4414B	TRANSFORMER	430 OLD SULFUR CT	50
430-TR-012-4414C	TRANSFORMER	430 OLD SULFUR CT	50
430-TR-013-4482	TRANSFORMER	430 OLD SULFUR CT ADDITION	500
# 51 (GLOBAL, 460V, 3 PHASE)	RECTIFIER	430 SOUR WATER TANK	18
# 52 (GLOBAL, 460V, 3 PHASE)	RECTIFIER	430 SOUR WATER TANK	18
# 53 (GLOBAL, 460V, 3 PHASE)	RECTIFIER	430 SOUR WATER TANK	53
# 54 (GLOBAL, 460V, 3 PHASE)	RECTIFIER	430 SOUR WATER TANK	21
431-TR-012-4412	TRANSFORMER	431 DEA (100 TON SRU)	175
432-TR-013-4191	TRANSFORMER	432 DOCKS (POWER POINT #4)	200
432-TR-021-4421	TRANSFORMER	432 EAST GUARD BASIN	183
432-TR-014-4425	TRANSFORMER	432 OLD LUBE OIL OFFICE	150

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
432-TR-013-3196A	TRANSFORMER	432 SUBSTATION C&P	83
432-TR-013-3196B	TRANSFORMER	432 SUBSTATION C&P	83
432-TR-013-3196C	TRANSFORMER	432 SUBSTATION C&P	83
432-TR-013-4192	TRANSFORMER	432 SUBSTATION C&P	307
None	TRANSFORMER	432 SUBSTATION C&P	164
None	TRANSFORMER	432 SUBSTATION C&P	164
None	TRANSFORMER	432 SUBSTATION C&P	164
432-TR-022-4424	TRANSFORMER	432 WASTEWATER (TANK 810, 811 ??)	167
432-TR-091-4093	TRANSFORMER	432 WEST GUARD BASIN (SUBSTATION #9)	285
432-TR-092-4096	TRANSFORMER	432 WEST GUARD BASIN (SUBSTATION #9)	285
432-TR-022-4422	TRANSFORMER	432J0001 waste water treatment building	196
434-TR-022-4442	TRANSFORMER	434 SRU (NORTH)	219
434-TR-021-4441	TRANSFORMER	434 SRU (SOUTH)	219
438-TR-012-4484	TRANSFORMER	438 BENZENE PRETREATMENT EQUALIZATION	161
438-TR-022-4481	TRANSFORMER	438 BENZENE STRIPPER	205
439-TR-021-4491	TRANSFORMER	439 SRU	362
439-TR-022-4492	TRANSFORMER	439 SRU	362
444-TR-002-4442	TRANSFORMER	444/445 SULFUR DEGASSING UNIT	186
445-TR-001-4451	TRANSFORMER	444/445 SULFUR DEGASSING UNIT	186
533-TR-021-4533	TRANSFORMER	533 COOLING TOWER	176
533-TR-014-4531	TRANSFORMER	533 STILL	225
533-TR-014-4532	TRANSFORMER	533 STILL	225
534-TR-053-3544	TRANSFORMER	534 CRUDE STILL	95
534-TR-053-4543	TRANSFORMER	534 CRUDE STILL	370
534-TR-053-4545	TRANSFORMER	534 CRUDE STILL	370
NONE	BREAKER	534 UNIT	144
511A	BREAKER	534 UNIT FEED	144
# 40 (ADAIR, 480V, 3 PHASE)	RECTIFIER	536 CRUDE UNIT	49

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
536-TR-071-4563	TRANSFORMER	536 SUB 612 (536 CRUDE)	222
536-TR-071-4565	TRANSFORMER	536 SUB 612 (536 CRUDE)	222
536-TR-071-5561	TRANSFORMER	536 SUB 612 (536 CRUDE)	1,837
536-TR-072-4564	TRANSFORMER	536 SUB 612 (536 CRUDE)	222
536-TR-072-4566	TRANSFORMER	536 SUB 612 (536 CRUDE)	222
536-TR-072-5562	TRANSFORMER	536 SUB 612 (536 CRUDE)	1,837
537-TR-052-4579	TRANSFORMER	537 COOLING TOWER	215
537-TR-053-4577	TRANSFORMER	537 COOLING TOWER	210
537-TR-053-4578	TRANSFORMER	537 COOLING TOWER	215
537P3713	BREAKER	537 COOLING TOWER PUMP	111
537-TR-002-4574	TRANSFORMER	537 CRUDE (2ND FROM NORTH)	364
537-TR-001-6575	TRANSFORMER	537 CRUDE (3RD FROM NORTH)	1,562
537-TR-002-6576	TRANSFORMER	537 CRUDE (4TH FROM NORTH)	1,562
537-TR-001-4571	TRANSFORMER	537 CRUDE (5TH FROM NORTH)	364
537-TR-002-4572	TRANSFORMER	537 CRUDE (6TH FROM NORTH)	364
537-TR-001-4573	TRANSFORMER	537 CRUDE (NORTH)	364
631-TR-691-4613	TRANSFORMER	631 HDS	371
631-TR-691-5611	TRANSFORMER	631 HDS	570
631-TR-691-5612	TRANSFORMER	631 HDS	570
632-TR-061-4621	TRANSFORMER	632 HDS	167
633-TR-071-4631	TRANSFORMER	633 SUB 312 (633 HDS)	222
633-TR-072-4632	TRANSFORMER	633 SUB 312 (633 HDS)	222
633-TR-071-6631	TRANSFORMER	633 SUB 312 (CENTER) (633C0001A)	810
633-TR-072-6632	TRANSFORMER	633 SUB 312 (SOUTH) (633C0001B)	810
633-TR-071-5633	TRANSFORMER	633 SUB 612 (HDS UNITS)	1,837
633-TR-072-5636	TRANSFORMER	633 SUB 612 (HDS UNITS)	1,837
634-TR-071-4641	TRANSFORMER	634 SUB 412 (634 HDS)	222
634-TR-072-4642	TRANSFORMER	634 SUB 412 (634 HDS)	222

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
635-TR-001-4653	TRANSFORMER	635 COOLING TOWER (OLD 735 C.T.)	260
635-TR-001-5651	TRANSFORMER	635 COOLING TOWER (OLD 735 C.T.)	295
635-TR-002-4654	TRANSFORMER	635 COOLING TOWER (OLD 735 C.T.)	260
635-TR-002-5652	TRANSFORMER	635 COOLING TOWER (OLD 735 C.T.)	295
635-TR-071-6651	TRANSFORMER	635 SUB 412/512 (NORTH) (635C0001A)	810
635-TR-072-6652	TRANSFORMER	635 SUB 412/512 (SOUTH) (635C0001B)	810
635-TR-071-4651	TRANSFORMER	635 SUB 512 (635 HDS)	222
635-TR-072-4652	TRANSFORMER	635 SUB 512 (635 HDS)	222
636-TR-071-6661	TRANSFORMER	636 HDS	1,554
636-TR-072-6662	TRANSFORMER	636 HDS	1,554
636-TR-071-4663	TRANSFORMER	636 HDS (NORTH)	332
636-TR-072-4664	TRANSFORMER	636 HDS (NORTH)	332
637-TR-071-4672	TRANSFORMER	637 HDS UNIT (2ND FROM NORTH)	372
637-TR-073-6673	TRANSFORMER	637 HDS UNIT (3RD FROM NORTH)	803
637-TR-071-6674	TRANSFORMER	637 HDS UNIT (4TH FROM NORTH)	803
637-TR-073-4671	TRANSFORMER	637 HDS UNIT (NORTH)	372
637-TR-000-7675	TRANSFORMER	637 KV SUBSTATION (WEST)	4,493
732-TR-691-5101	TRANSFORMER	732 - SUB #10	652
732-TR-694-5102	TRANSFORMER	732 - SUB #10	652
732-TR-693-5724	TRANSFORMER	732 EAST MCC BLDG (2ND FROM EAST)	1,095
732-TR-692-4727	TRANSFORMER	732 EAST MCC BLDG (3RD FROM EAST)	327
732-TR-693-4728	TRANSFORMER	732 EAST MCC BLDG (4TH FROM EAST)	327
732-TR-692-5723	TRANSFORMER	732 EAST MCC BLDG (EAST)	1,095
732-TR-052-4726	TRANSFORMER	732 FLUID COOLING TOWER (NORTH)	290
732-TR-053-4727	TRANSFORMER	732 FLUID COOLING TOWER (SOUTH)	290
732-TR-042-4725	TRANSFORMER	732 FLUID GAS PLANT	300
732-TR-051-3721	TRANSFORMER	732 FLUID NORMAL LTG.	120
732-TR-051-4721	TRANSFORMER	732 FLUID PRECIP. MCC	190

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
732-TR-694-4726	TRANSFORMER	732 WEST MCC BLDG (NORTH)	544
732-TR-691-4725	TRANSFORMER	732 WEST MCC BLDG (SOUTH)	544
LEF FEED	BREAKER	733 FORECED DRAFT FAN STARTER	103
733P0001B	BREAKER	733 MOTOR STARTER	103
733P0001C	BREAKER	733 MOTOR STARTER	103
733P0002B	BREAKER	733 MOTOR STARTER	111
733P0002C	BREAKER	733 MOTOR STARTER	103
733P0003	BREAKER	733 MOTOR STARTER	103
733P0005A	BREAKER	733 MOTOR STARTER	103
733P0007	BREAKER	733 MOTOR STARTER	103
733P0007B	BREAKER	733 MOTOR STARTER	111
733P0010	BREAKER	733 MOTOR STARTER	103
733P0010B	BREAKER	733 MOTOR STARTER	111
733P0011	BREAKER	733 MOTOR STARTER	103
733P0021	BREAKER	733 MOTOR STARTER	111
733P0021A	BREAKER	733 MOTOR STARTER	111
733P1002A	BREAKER	733 MOTOR STARTER	103
733-TR-051-4731	TRANSFORMER	733 REFORMER	195
733-TR-052-3731	TRANSFORMER	733 REFORMER	122
733-TR-052-4733	TRANSFORMER	733 REFORMER	279
734-TR-692-4744	TRANSFORMER	734 BTU	165
734-TR-692-4746	TRANSFORMER	734 BTU	165
734-TR-692-5742	TRANSFORMER	734 BTU	235
734-TR-693-4743	TRANSFORMER	734 BTU	165
734-TR-693-4745	TRANSFORMER	734 BTU	165
734-TR-693-5741	TRANSFORMER	734 BTU	235
734-TR-001-6691	TRANSFORMER	734 SUBSTATION 69 (FAR EAST)	1,960
735-TR-001-4751	TRANSFORMER	735 MAG	385

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
735-TR-001-5751	TRANSFORMER	735 MAG	380
735-TR-002-4752	TRANSFORMER	735 MAG	385
735-TR-002-5752	TRANSFORMER	735 MAG	380
735-TR-001-6752	TRANSFORMER	735 MAG (735C0001)	2,350
735-TR-002-6751	TRANSFORMER	735 MAG (735C0002)	320
Regen Air	BREAKER	735 MOTOR STARTER	103
735C0003	BREAKER	735 MOTOR STARTER REFRIG COMP	103
736-TR-761-4761	TRANSFORMER	736 CATALYST BUILDING (POWER POINT #2)	200
736-TR-032-4762	TRANSFORMER	736 COKER	405
736-TR-032-4763	TRANSFORMER	736 COKER	405
736-TR-032-5761	TRANSFORMER	736 COKER	1,040
736-TR-032-5764	TRANSFORMER	736 COKER COMPRESSOR	470
736-TR-761-4764	TRANSFORMER	736 COKER OFFSITE	160
737-TR-031-4773	TRANSFORMER	737 COKER (EAST BLDG - 2ND FROM WEST)	364
737-TR-032-6772	TRANSFORMER	737 COKER (EAST BLDG - 3RD FROM WEST)	580
737-TR-031-6771	TRANSFORMER	737 COKER (EAST BLDG - 4TH FROM WEST)	580
737-TR-032-4774	TRANSFORMER	737 COKER (EAST BLDG - WEST)	364
737-TR-032-4776	TRANSFORMER	737 COKER (WEST BLDG - 2ND FROM WEST)	364
737-TR-031-6777	TRANSFORMER	737 COKER (WEST BLDG - 3RD FROM WEST)	793
737-TR-031-4775	TRANSFORMER	737 COKER (WEST BLDG - WEST)	364
NONE	TRANSFORMER	737 COKER T/A COMPLEX	65
737-TR-001-7033	TRANSFORMER	737 SUBSTATION #3 (WEST)	2,140
831-TR-014-4812	TRANSFORMER	831 EAST VFD	210
831-TR-014-4811	TRANSFORMER	831 WEST VFD	170
931-TR-062-4911	TRANSFORMER	931 ISOM I	100
931-TR-063-4912	TRANSFORMER	931 ISOM I	100
933P0510A	BREAKER	933 MOTOR STARTER	326
933P0510B	BREAKER	933 MOTOR STARTER	326

Table 2-4 Oil-Filled Electrical Equipment List

FLN / Description	Type	Location	Gallons
934-TR-061-4941	TRANSFORMER	934 ORTHO 2	112
935-TR-062-4951	TRANSFORMER	935 PHASE 0	380
935-TR-063-4952	TRANSFORMER	935 PHASE 0	380
936-TR-062-4962	TRANSFORMER	936 PHASE I	260
936-TR-063-4961	TRANSFORMER	936 PHASE I	260
938-TR-691-4981	TRANSFORMER	938 PHASE II	380
938-TR-691-5981	TRANSFORMER	938 PHASE II	735
938-TR-694-4982	TRANSFORMER	938 PHASE II	380
938-TR-694-5982	TRANSFORMER	938 PHASE II	735
988-TR-043-3982	TRANSFORMER	988 LABORATORY (CENTER)	170
988-TR-043-4981	TRANSFORMER	988 LABORATORY (NORTH - CHILLER)	215
988-TR-043-4983	TRANSFORMER	988 LABORATORY (SOUTH)	90

Table 2-5 Basin Summary

Area	Tanks Included	Location Description
225-01	887, 890	225TF, S of Hwy 225, W of Scarborough, E end of tank farm
225-02	885, 886	225TF, S of Hwy 225, W of Scarborough.
225-03	882, 883, 884	225TF, S of Hwy 225 W of Scarborough.
225-04	879, 880, 881	225TF, S of Hwy 225 W of Scarborough.
225-05	876, 878	225TF, S of Hwy 225, W of Scarborough, W end of tank farm.
ETF-01	30, 100	ETF, E side of refinery near Light Co. Road.
ETF-02	597, 674	ETF, E side of refinery, N of Lawndale, and NE of FCCU
ETF-03	594, 600	ETF, E side of refinery, N of Lawndale, and NE of FCCU
ETF-04	6	ETF, E side of refinery, WSW of Gate 5
ETF-05	558	ETF, E of Old Wax Plant, eastern boundary of refinery.
ETF-06	559	ETF, E of Old Wax Plant, eastern boundary of refinery.
STF-01	560, 561	STF, W of Scarborough, S of Lawndale and N of Hwy 225.
STF-02	562, 563	STF, W of Scarborough, S of Lawndale and N of Hwy 225.
STF-03	564, 565	STF, W of Scarborough, S of Lawndale, and N of Hwy 225.
STF-04	808	STF, W of Scarborough, S of Lawndale, and N of Hwy 225.
STF-05	809	STF, W of Scarborough, S of Lawndale, and N of Hwy 225.
STF-06	806, 807	STF, E of Allen-Genoa, S of Lawndale, and N of Hwy 225.
STF-07	570, 571	STF, E of Allen-Genoa, S of Lawndale, and N of Hwy 225.
STF-08	572, 573	STF, E of Allen-Genoa, S of Lawndale and N of Hwy 225.
STF-09	574	STF, E of Allen-Genoa, S of Lawndale and N of Hwy 225.
STF-10	576, 577	STF, W of Allen-Genoa, S of Lawndale, and N of Hwy 225.
STF-11	578, 579	STF, W of Allen-Genoa, S of Lawndale, and N of Hwy 225.
WTF-01	911, 601	WTF, NW of Gate 2, N of Lawndale
WTF-02	850	WTF, W of Gate 2, N of Lawndale
WTF-03	11	WTF, E of Gate 1, N of Lawndale
WTF-04	619	WTF, NE of Gate 1, N of Lawndale
WTF-05	607	WTF, W of Gate 1, N of Lawndale, W side of refinery
WTF-06	867	WTF, W of Gate 1, N of Lawndale, W side of refinery
WTF-07	609	WTF, W of Gate 1, N of Lawndale, W side of refinery
WTF-08	613	WTF, W of Gate 1, N of Lawndale, W side of refinery
HOTF-01	1, 26, 892, 893	HOTF, E of 533 Crude, eastern NE boundary of refinery

Table 2-6 Secondary Containment Areas for Bulk Storage Tanks

Basin Number	Function Location Number	Max Fill Capacity (bbls)	Roof Type	Tank Diameter (ft)	Tank Height (ft)	Tank Area (ft ²)	Max Basin Area (ft ²)	Net Basis Area (ft ²)	Low Dike Wall Elev (ft ASL)	Avg Basin Floor Elev (ft ASL)	Max Basin Volume (bbls)	Available Basin Vol (bbls)	110% Vol Large Tank (bbls)
225-01	133TK0887	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		34,636	353,940	322,524	35.0	29.7	(b) (7)(F), (b) (3)		
	133TK0890		EFR			31,416							
						34,636							
225-02	133TK0885	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		34,636	321,576	286,940	35.7	29.5	(b) (7)(F), (b) (3)		
	133TK0886		EFR			34,636							
						34,636							
225-03	133TK0882	(b) (7)(F), (b) (3)	IFR	(b) (7)(F), (b) (3)		31,416	416,978	354,146	35.3	29.1	(b) (7)(F), (b) (3)		
	133TK0883		IFR			31,416							
	133TK0884		IFR			31,416							
						31,416							
225-04	133TK0879	(b) (7)(F), (b) (3)	IFR	(b) (7)(F), (b) (3)		31,416	458,935	396,103	35.5	29.7	(b) (7)(F), (b) (3)		
	133TK0880		IFR			31,416							
	133TK0881		IFR			31,416							
						31,416							
225-05	133TK0876	(b) (7)(F), (b) (3)	IFR	(b) (7)(F), (b) (3)		31,416	366,780	335,364	35.0	29.4	(b) (7)(F), (b) (3)		
	133TK0878		IFR			31,416							
225-05 Basin:						31,416	366,780	335,364	35.0	29.4	(b) (7)(F), (b) (3)		
225-03/04/05 Basins (Interconnected):						31,416	1,242,692	1,022,781	35.0	29.4	(b) (7)(F), (b) (3)		
WTF-01	134TK0911	(b) (7)(F), (b) (3)	VFR	(b) (7)(F), (b) (3)		5,153	71,520	66,367	31.3	23.8	(b) (7)(F), (b) (3)		
WTF-02	134TK0601		VFR			10,387							
			ETF-01/02			10,387							
WTF-03	134TK0850	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		25,447	64,451	64,451	29.8	24.4	(b) (7)(F), (b) (3)		
WTF-04	134TK0011		EFR			21,382							
WTF-05	134TK0619		EFR			17,671							
ETF-03/04/05 Basins (Interconnected):						21,382	245,322	206,268	29.8	24.5	(b) (7)(F), (b) (3)		
WTF-06	134TK0607	(b) (7)(F), (b) (3)	-	(b) (7)(F), (b) (3)		0	163,134	156,772	28.6	24.2	(b) (7)(F), (b) (3)		
	134TK0867		IFR			6,362							
	134TK0609		VFR			25,447							
						25,447							
WTF-07	134TK0613	(b) (7)(F), (b) (3)	IFR	(b) (7)(F), (b) (3)		17,671	109,652	91,981	28.5	24.1	(b) (7)(F), (b) (3)		
						WTF-06/07							
STF-01	135TK0560	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		11,310					(b) (7)(F), (b) (3)		

Table 2-6 Secondary Containment Areas for Bulk Storage Tanks

Basin Number	Function Location Number	Max Fill Capacity (bbls)	Roof Type	Tank Diameter (ft)	Tank Height (ft)	Tank Area (ft ²)	Max Basin Area (ft ²)	Net Basis Area (ft ²)	Low Dike Wall Elev (ft ASL)	Avg Basin Floor Elev (ft ASL)	Max Basin Volume (bbls)	Available Basin Vol (bbls)	110% Vol Large Tank (bbls)	
STF-02	135TK0561	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		11,310	173,814	162,505	28.4	24.0	(b) (7)(F), (b) (3)			
						11,310								
	135TK0562					11,310								
	135TK0563					11,310								
STF-03	135TK0564	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		11,310	196,132	184,823	28.8	24.5	(b) (7)(F), (b) (3)			
	135TK0565					25,447								
						25,447								
STF-04	135TK0808	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		25,447	80,257	80,257	29.2	24.2	(b) (7)(F), (b) (3)			
						25,447								
STF-02/03/04 Basins (Interconnected):						25,447	469,287	409,911	28.8	24.5	(b) (7)(F), (b) (3)			
STF-05	135TK0809	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		25,447	79,831	79,831	30.1	24.9	(b) (7)(F), (b) (3)			
	STF-06					135TK0806								25,447
	135TK0807	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		25,447					(b) (7)(F), (b) (3)			
STF-06 Basin:						25,447	195,943	170,496	30.6	25.4	(b) (7)(F), (b) (3)			
STF-05/06 Basins (Interconnected):						25,447	275,774	224,880	30.1	25.2	(b) (7)(F), (b) (3)			
STF-07	135TK0570	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		11,310	90,081	90,081	29.3	24.3	(b) (7)(F), (b) (3)			
	STF-08					135TK0571								16,286
STF-07/08 Basins (Interconnected):						16,286	189,303		29.2	24.4	(b) (7)(F), (b) (3)			
STF-08	135TK0572	(b) (7)(F), (b) (3)	VFR	(b) (7)(F), (b) (3)		16,286	244,181	227,895	30.0	26.0	(b) (7)(F), (b) (3)			
	135TK0573		EFR			17,671								
						17,671								
STF-09	135TK0574	(b) (7)(F), (b) (3)	VFR	(b) (7)(F), (b) (3)		17,671		0			(b) (7)(F), (b) (3)			
STF-10	135TK0576	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		17,671	287,588	269,916	31.8	26.5	(b) (7)(F), (b) (3)			
	135TK0577					EFR								17,671
														17,671
STF-11	135TK0578	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		31,416	299,092	267,676	32.2	26.7	(b) (7)(F), (b) (3)			
	135TK0579					EFR								31,416
														31,416
ETF-01	136TK0030	(b) (7)(F), (b) (3)	IFR	(b) (7)(F), (b) (3)		6,362	69,634	69,634	27.3	23.0	(b) (7)(F), (b) (3)			
ETF-02	136TK0100	(b) (7)(F), (b) (3)	EFR	(b) (7)(F), (b) (3)		15,394	57,772	57,772	27.1	22.3	(b) (7)(F), (b) (3)			

Table 2-6 Secondary Containment Areas for Bulk Storage Tanks

Basin Number	Function Location Number	Max Fill Capacity (bbls)	Roof Type	Tank Diameter (ft)	Tank Height (ft)	Tank Area (ft ²)	Max Basin Area (ft ²)	Net Basin Area (ft ²)	Low Dike Wall Elev (ft ASL)	Avg Basin Floor Elev (ft ASL)	Max Basin Volume (bbls)	Available Basin Vol (bbls)	110% Vol Large Tank (bbls)
ETF-03	138TK0006	(b) (7)(F),	EFR	(b) (7)(F),	(b) (3)	11,310	36,042	36,042	27.7	23.0	(b) (7)(F),	(b) (3)	
			ETF-01/02/03			15,394	163,447	145,776	27.1	22.8			
ETF-04	136TK0597	(b) (7)(F),	EFR			13,273	49,018	49,018	29.9	23.6			
ETF-05	136TK0674	(b) (3)	EFR			17,671	52,408	52,408	30.1	24.7			
ETF-06	136TK0594		EFR			17,671							
	136TK0600		EFR			17,671	136,780	119,108	29.7	24.5			
			ETF-04/05/0			17,671	238,207	189,590	29.7	24.3			
ETF-07	136TK0558	(b) (7)(F),	EFR			14,103	60,953	60,953	27.1	20.4			
ETF-08	136TK0559	(b) (3)	EFR			14,103	54,338	54,338	27.1	20.0			
			ETF-06/07			14,103	115,290	101,188	27.1	20.2			
ETF-09	136TK0582	(b) (7)(F),	EFR			20,106	73,957	73,957	29.5	23.6			
ETF-10	136TK0583	(b) (3)	EFR			20,106	75,000	75,000	28.6	23.5			
ETF-11	136TK0584		EFR			20,106	77,575	77,575	28.6	23.3			
			ETF-03/04/05			20,106	226,532	186,320	28.6	23.5			
HOTF-01	138TK0001	(b) (7)(F),	VFR			7,854							
	138TK0026	(b) (3)	EFR			7,854							
	138TK0892		EFR			7,854							
	138TK0893		EFR			7,854							
	430TK4001		IFR			7,854							
	430TK4002		IFR			7,854							
			HOTF-01 Basin:			7,854	172,504	133,234	25.3	22.3			

Tank containment dike areas, lowest dike wall elevations, and basin floor elevations from aerial topographic data prepared by Gulf Coast Aerial Mapping, Baton Rouge, LA (May 2011).

Tank containment areas with insufficient volumes located within or adjacent to operating process areas are contained within refinery surface impoundment basins.

Table 2-7 HRO Pipeline in Tunnel Under Roadways

Operator List ID#	Assigned Pipeline No.	Line Description	Size (in)	Service	Location Description	Operator
1	PL01	OP Transfer Line	12	Naphtha Heating Oil Delivery	Pipeline Tunnel (under Highway 225)	HRO
1	PL01	OP Transfer Line	12	Naphtha, Heating Oil	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
2	PL02	Gasoline to shops	4	Gasoline (Out-of-Service)	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
3	PL03	C7 Gas products P, L	6	Gasoline, C7+	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
3	PL03	Unit Delivery	8	Heavy Pyrolysis Gasoline	North Pipeline Tunnel (under Allen Genoa)	HRO
4	PL04	Patch-up line	8	Distillate, #2 Fuel	Pipeline Tunnel (under Highway 225)	HRO
4	PL04	Patch-up line	8	Distillate, #2 Fuel	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
5	PL05	USM (Blender loop #2)	8	Gasoline	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
6	PL06	Utility	10	Distillate, Utility Heavy Oil	Pipeline Tunnel (under Highway 225)	HRO
6	PL06	Utility	10	Distillate, Utility Gas Oil Line	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
7	PL07	Gathering Line	10	Gas Oil	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
8	PL08	HO Delivery	12	Diesel, HGO Delivery	Pipeline Tunnel (under Highway 225)	HRO
8	PL08	HO Delivery	12	Diesel, 633 HDS Production	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
9	PL09	Magnaformer Reformate	8	Magnaformer Reformate	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
10	PL10	USM Dock Line	16	Gasoline	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
11	PL11	Export Distillate Dock line	16	Diesel, LCO	Pipeline Tunnel (under Highway 225)	HRO
11	PL11	Export Dock line	16	Distillate	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
14	PL12	Kerosene dock line	16	Kerosene	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
12	PL13	Export (Blender loop #8)	6	Toluene	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
13	PL14	Oily Water	6	Oily Water	Pipeline Tunnel (under Highway 225)	HRO
13	PL14	NESHAP Wastewater	6	Oil Water	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
15	PL15	Condensate Dock Line	20	Naphtha, Heat 01 Discharge To Docks	Pipeline Tunnel (under Highway 225)	HRO

Table 2-7 HRO Pipeline in Tunnel Under Roadways

Operator List ID#	Assigned Pipeline No.	Line Description	Size (in)	Service	Location Description	Operator
15	PL15	Condensate Dock Line	20	Naphtha, Heat Oil Discharge. To Docks	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
17	PL16	Texas City Crude	18	Crude Oil	Pipeline Tunnel (under Highway 225)	HRO
18	PL16	ARCO PL to ETF from 20" Crude Line	20	Crude Oil	Under Lawndale at TK560	HRO
18	PL16	20" crude pipeline	10	Crude Oil	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
18	PL16	20" crude pipeline	12	Crude Oil	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
19	PL17	Kerosene Rundown	6	Kerosene	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
20	PL18	Light Fluid Gasoline	8	Gasoline	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
	PL19	Oily water from STF	6	Oily Water	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
39	PL19	NESHAP	8	Oily Water	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
	PL20	Butane	6	Butane	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
22	PL21	Loop 12 NC4 to Blender	6	Butane	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
28	PL22	Loop 11 (NC4 to Blender) WTF to Blender	8	Butane	West of Main Office (under Lawndale)	HRO
25	PL23	Extension of #4 Equistar Pipeline	6	Butane	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
24	PL26	C5 Raffinate from ARCO (STF) to WTF 134TK831)	6	Pentane Out-of-Service	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
--	PL27	Alkylate from BP	6	Alkylate	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
21	PL29	HCF btms to STF (Heavy Aromatics)	8	Heavy Aromatics	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
16	PL33	36" crude pipeline	20	Crude Oil	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
18	PL33	36" crude pipeline	18	Crude Oil	Pipeline Tunnel (under Highway 225)	HRO
18	PL33	36" crude pipeline	18	Crude Oil	Pipeline Tunnel (under Highway 225)	HRO

Table 2-7 HRO Pipeline in Tunnel Under Roadways

Operator List ID#	Assigned Pipeline No.	Line Description	Size (in)	Service	Location Description	Operator
—	NA	OTTI to 20" crude line and 36" crude line	16	Crude Oil	NO road crossings	HRO
23	PL34	Pentane Loop 10 (Pentane to Blender)	12	Pentane	Pipeline Tunnel @ #2 Gate (under Lawndale)	HRO
26	PL35	Reformat (Hvy Fluid from Mag to STF)	8	Gasoline	West of Main Office to TK806 (under Lawndale)	HRO
31	PL39	Distillate Pipeline (Citgo)	18	Heat Oil to Products PL	Pipeline Tunnel (under Highway 225)	HRO
32	PL40	16" PX	16	Gasoline	North Pipeline Tunnel (under Allen Genoa)	HRO
33	PL41	#4 Header	16	Gasoline	North Pipeline Tunnel (under Allen Genoa)	HRO
34	PL42	#1 Allendale	12	Gasoline	North Pipeline Tunnel (under Allen Genoa)	HRO
35	PL43	#2 Allendale	12	Gasoline	North Pipeline Tunnel (under Allen Genoa)	HRO
36	PL44	P-5B Discharge Blend Header	12	Gasoline	North Pipeline Tunnel (under Allen Genoa)	HRO
37	PL45	12" Raffinate	12	Gasoline	North Pipeline Tunnel (under Allen Genoa)	HRO
38	PL47	BT Raffinate	6	Gasoline	South Pipeline Tunnel (under Allen Genoa)	HRO
40	PL49	Aviation	16	Diesel, NGO	#1 Gate to TK573 (under Lawndale)	HRO
38	PL50	BT Raffinate	6	Gasoline	West of FCCU to TK564 (under Lawndale)	HRO
41, 42		Colonial	12	Heating Oil, Diesel, NGO	#1 Gate to TK573 (under Lawndale)	HRO

Table 4-2 USCG Worst-Case Discharge Volume Calculation – Marine Docks

Dock	Loading Arm	Line	Line Length (ft)*	Pipe Diameter (in)	Discovery Time (sec)	Shutdown Time (sec)	Pumping Rate (bbls/hr)	USCG Worst - Case Discharge (bbls)
A	LA-101	# 1 Crude	160	12	(b) (7)(F), (b) (3)			
A	LA-101	Grade A Crude	160	8				
A	LA-101	Bunker C	160	12				
A	LA-102	6" HIPO	160	6				
A	LA-102	6" USM	160	6				
A	LA-102	12" USM	160	12				
A	LA-102	Kerosene	160	12				
A	LA-102	Heating Oil	160	12				
A	LA-102	12" Aviation	160	12				
A	LA-102	Condensate	160	12				
A	LA-103	Toluene	160	8				
A	LA-103	Benzene	160	8				
A	LA-104	Toluene	160	8				
A	LA-104	MTBE	160	8				
A	LA-105	6" HIPO	160	6				
A	LA-105	6" USM	160	6				
A	LA-105	12" USM	160	12				
A	LA-105	Kerosene	160	12				
A	LA-105	Heating Oil	160	12				
A	LA-105	12" Aviation	160	12				
A	LA-105	Condensate	160	12				
A	LA-106	Dripolene	160					
A	LA-106	Crude #2	160	12				

Table 4-2 USCG Worst-Case Discharge Volume Calculation – Marine Docks

Dock	Loading Arm	Line	Line Length (ft)*	Pipe Diameter (in)	Discovery Time (sec)	Shutdown Time (sec)	Pumping Rate (bbls/hr)	USCG Worst - Case Discharge (bbls)
B	LA-301	#1 Crude	160	24	(b) (7)(F), (b) (3)			
B	LA-301	Bunker C	160	18				
B	LA-302	#1 Crude	160	24				
B	LA-302	#2 Crude	160	20				
B	LA-303	6" HIPO	160	6				
B	LA-303	6" USM	160	6				
B	LA-303	12" USM	160	12				
B	LA-303	Kerosene	160	12				
B	LA-303	Heating Oil	160	12				
B	LA-303	12" Aviation	160	12				
B	LA-303	Condensate	160	18				
B	LA-303	Arconol	160					
B	LA-304	6" HIPO	160	6				
B	LA-304	6" USM	160	6				
B	LA-304	12" USM	160	12				
B	LA-304	Kerosene	160	12				
B	LA-304	Heating Oil	160	12				
B	LA-304	12" Aviation	160	12				
B	LA-304	Condensate	160	18				
B	LA-304	Arconol	160					
B	LA-305	6" HIPO	160	6				
B	LA-305	6" USM	160	6				
B	LA-305	12" USM	160	12				

Table 4-2 USCG Worst-Case Discharge Volume Calculation – Marine Docks

Dock	Loading Arm	Line	Line Length (ft)*	Pipe Diameter (in)	Discovery Time (sec)	Shutdown Time (sec)	Pumping Rate (bbls/hr)	USCG Worst - Case Discharge (bbls)
B	LA-305	Kerosene	160	12	(b) (7)(F), (b) (3)			
B	LA-305	Heating Oil	160	12				
B	LA-305	12" Aviation	160	12				
B	LA-305	Condensate	160	18				
B	LA-305	Arconol	160					
B	LA-306	Orthoxylene	160	8				
B	LA-306	Paraxylene	160	8				
B	LA-306	Xylene	160	8				
B	LA-307	Lube Agitator #2	160					
B	LA-307	Lube Agitator #1	160					
B	LA-307	Neutral (Lube)	160					
B	LA-307	Aircraft (Lube)	160					
B	LA-307	Extra Lube	160					
C	LA-501	Bunker C	50	18				
C	LA-501	#1 Crude	50	24				
C	LA-501	Condensate	50	18				
C	LA-502	Benzene	50	8				
C	LA-502	Toluene	50	8				
C	LA-502	Orthoxylene	50	8				
C	LA-502	Paraxylene	50	8				
C	LA-502	Xylene	50	8				
C	LA-503	XV from LA-509 & 506	25	6				
C	LA-504	White Oil	50	6				

Table 4-2 USCG Worst-Case Discharge Volume Calculation – Marine Docks

Dock	Loading Arm	Line	Line Length (ft)*	Pipe Diameter (in)	Discovery Time (sec)	Shutdown Time (sec)	Pumping Rate (bbls/hr)	USCG Worst - Case Discharge (bbls)
C	LA-505	Lube Manifold	160	8	(b) (7)(F), (b) (3)			
C	LA-506	SRF	60					
C	LA-506	6" HIPO	60	6				
C	LA-506	6" USM	60	6				
C	LA-506	(Line to LA-503)	25	6				
C	LA-507	Lube Manifold	160	8				
C	LA-508	Lube Manifold	160	8				
C	LA-509	Benzene	70	8				
C	LA-509	Toluene	70	8				
C	LA-509	Orthoxylene	70	8				
C	LA-509	Paraxylene	70	8				
C	LA-509	Xylene	70	8				
C	LA-509	(Line to LA-503)	35	6				
C	LA-510	SRF	70					
C	LA-511	Grade "A" Crude	75	8				

* Length includes length of pipeline from first block valve (pit) to end of loading arm (marine transfer manifold)

Table 4-3 Historical Tank Failures (1996 – 2013)

Tank No.	Date	Root Cause	Actions Taken
133TK0883	07/15/96	Hole in floor of tank	11 bbls of low sulfur diesel fuel spilled inside dike wall. Spill was cleaned up, and tank was emptied and repaired.
136TK0764	06/02/97	Hole in bottom of tank	~ 4 bbls of auto transmission fluid spilled into dike wall. Spill cleaned up, tank emptied and taken out of service.
137TK0815	12/18/97	Hole in tank floor	~ 4 bbls of Coker Naphtha spilled inside dike wall. Spill cleaned up, tank emptied and repaired.
430TK0871	11/02/98	Hole in side of tank	~ 2 bbls of molten sulfur spilled inside dike wall. Spill cleaned up, tank emptied and repaired.
432TK0855	12/12/98	Holes in tank roof.	Tank was removed from service, cleaned and degassed, and new roof installed in 1999.
432TK0855	09/20/99	Roof was sunk due to an operational upset which punctured two holes in the tank bottom.	Tank was removed from service, cleaned and degassed, new roof installed, and the tank floor repaired.
		No tank failures in 2000	
135TK565	04/12/01	Seal on mixer motor developed a leak causing gasoline to leak to ground.	Tank emptied to get level below mixer motor seal and mixer motor seal was replaced.
133TK0890	06/09/01	Tank roof sunk during Tropical Storm Allison	Area cleaned up, tank emptied and degassed, and roof replaced.
134TK0618	06/09/01	Tank roof sunk during Tropical Storm Allison	Area cleaned up, tank emptied and degassed, and roof replaced.
135TK0564	06/09/01	Tank roof sunk during Tropical Storm Allison	Area cleaned up, tank emptied and degassed, and roof replaced.
136TK0441	06/09/01	Tank roof sunk during Tropical Storm Allison	Area cleaned up, tank emptied and degassed, and roof replaced.
137TK0800	06/09/01	Tank roof sunk during Tropical Storm Allison	Area cleaned up, tank emptied and degassed, and roof replaced.
137TK0805	06/09/01	Tank roof sunk during Tropical Storm Allison	Area cleaned up, tank emptied and degassed, and roof replaced.
138TK0893	06/13/01	During routine inspection, corrosion was found on the floor seam and roof pontoons	Corrosion was repaired and water was removed from pontoons.

Table 4-3 Historical Tank Failures (1996 – 2013)

Tank No.	Date	Root Cause	Actions Taken
		were found with water.	
138TK0652	11/01/01	Hole found in tank floor.	Oil pumped from tank, tank removed from service, and tank floor replaced in 2002.
		No tank failures in 2002	
		No tank failures in 2003	
136TK0441	02/10/04	Roof drain was found leaking toluene into the dike wall and stormwater drain.	Blocked in roof drain
133TK0878	07/22/04	Tank was found leaking at the tank floor.	Tank was removed from service and may be demolished
138TK0893	09/30/04	Water found in #4 pontoon during routine inspection.	Water was removed from pontoon and corrosion was repaired.
138TK0771	11/11/04	Tank overflowed into the lube area north of 533CT3701.	The area was barricaded and the equipment isolated.
133TK0883	01/10/05	Leaking from north east side around base of tank.	Tank removed from service.
136TK0584	01/21/05	Tank roof drain leak to soil.	Isolated roof drain and dispatched a vacuum truck.
136TK0583	03/06/06	Crude found on roof due to faulty seals.	Roof was cleaned and seal repairs completed.
137TK0798	04/03/06	Orthoxylene found on tank roof due to faulty seal.	Roof cleaned and seal repaired.
138TK0893	05/05/06	Crude found on tank roof and dripping from roof drain due to faulty seal.	Area cleaned and seal repaired.
137TK0412	05/16/06	During routine inspection, corrosion was found on the floor seam.	Tank removed from service and new floor was installed above old floor.
138TK0202	05/23/06	Suction valve failed causing pale oil to spill to ground.	Area cleaned and valve repaired.
136TK0600	05/25/06	Product found on tank roof due to cracked roof weld.	Roof was clean, tank removed from service, and crack repaired.
138TK0893	06/06/06	Crude found on tank roof and dripping from roof drain due to roof corrosion.	Area cleaned and roof repaired.

Table 4-3 Historical Tank Failures (1996 – 2013)

Tank No.	Date	Root Cause	Actions Taken
137TK0804	06/21/06	Coker slop oil found on tank roof and dripping from roof drain due to faulty seal.	Area cleaned and seal repaired.
138TK0651	07/07/06	During routine inspection, lube oil distillate found leaking from tank floor seam.	Area cleaned, tank removed from service, emptied and degassed, and floor seam repaired.
135TK0806	08/02/06	During routine inspection, two small holes found in tank roof.	Roof was cleaned and pinholes were repaired.
133TK0886	08/03/06	Crude found on tank roof from secondary seal failure.	Cleaned product from roof and repaired holes in secondary seal.
134TK0774	08/03/06	Crude found on tank roof from leaking seal.	Cleaned product from roof and seal was repaired.
134TK0775	08/18/06	Crude found coming from roof drain onto ground.	Closed roof drain, cleaned up spill, and repaired roof seal.
138TK0893	08/20/06	Two small holes were found in roof during routine inspection.	Holes were repaired using Belzona.
134TK0802	09/19/06	Crude found on tank roof from leaking seal.	Cleaned product from roof and repaired roof seal.
135TK0563	10/03/06	During routine inspection, small pinhole found on internal roof drain.	Pinhole was repaired.
136TK0600	11/21/06	Product found on tank roof and dripping from roof drain due to tear in primary seal.	Area cleaned, tank removed from service, emptied and degassed, and seal repaired.
136TK0584	01/11/07	Crude found on roof due to faulty seals.	Roof cleaned, tank removed from service, emptied and degassed, and seal repaired.
136TK0583	01/23/07	Crude found on tank roof and dripping from roof drain due to faulty seal.	Area cleaned and seal repaired.
137TK0412	02/06/07	During routine inspection, tank roof seals were found defective.	Tank removed from service, emptied and degassed, and new roof seals were installed.
138TK0856	06/09/07	During routine inspection, 2 gallons of pale oil leaked from tank floor seam.	Area cleaned, tank removed from service, and turned over to maintenance for repaired.
136TK0594	08/12/08	~65 bbls of crude found on roof due to roof displacement from gas bubble.	Area cleaned and seal inspected and repaired as needed.

Table 4-3 Historical Tank Failures (1996 – 2013)

Tank No.	Date	Root Cause	Actions Taken
137TK0803	11/21/08	~16 bbls of slop oil found on roof due to overfilling the tank.	Area cleaned and seal inspected and repaired as needed.
137TK0425	11/22/08	~11 bbls of slop oil found on roof due to overfilling the tank.	Area cleaned and seal inspected and repaired as needed.
134TK0597	12/16/08	~ 5 gal of VGO found on roof following 634 HDS shutdown	Area cleaned and seal repaired.
134TK0597	03/02/09	~2.5 bbls of VGO found on roof following 634 HDS compressor trip.	Area cleaned and seal repaired.
133TK0880	05/20/09	Internal floating roof was found not floating.	Tank was isolated, emptied, degassed, cleaned and tank roof/seals repaired.
138TK0892	08/12/09	~3 gal of Grade A crude found on roof from pinhole leak.	Area cleaned and holes were repaired using Belzona.
138TK0893	08/20/09	~10 gal of Grade A crude found on roof from pinhole leak.	Area cleaned and holes were repaired using Belzona.
138TK0893	10/19/09	~0.25 gal of crude was found leaking from old leak repair.	Area cleaned and holes were repaired using Belzona.
138TK0893	12/03/09	~10 gal of Grade A crude found on roof from pinhole leak.	Area cleaned and holes were repaired using Belzona.
138TK0273	12/10/09	~1.5 bbls of lube oil was found leaking from pinholes on tank shell.	Tank was isolated, emptied, degassed, cleaned and tank shell repaired.
430TK4001	05/26/10	Internal floating roof was found not floating.	Tank was isolated, emptied, degassed, cleaned and tank roof/seals repaired.
135TK0560	07/03/10	~37 bbls of gasoline was from leaking from roof seal.	Tank was isolated, emptied, degassed, cleaned and roof seal repaired.
430TK4002	07/22/10	~15 bbls of oil was from leaking from roof seal.	Tank was isolated, emptied, degassed, cleaned and roof seal repaired.
138TK0650	08/02/10	~5 gal of lube oil was from leaking from roof floor plate.	Tank was isolated, emptied, degassed, cleaned and tank floor repaired.
138TK0892	08/06/10	~15 gal of Grade A crude found on roof from pinhole leak.	Area cleaned and holes were repaired using Belzona.

Table 4-3 Historical Tank Failures (1996 – 2013)

Tank No.	Date	Root Cause	Actions Taken
136TK0594	10/12/10	~25 gal of crude found on roof due to undetermined cause.	Area cleaned and seal inspected.
136TK0594	11/22/10	~60 bbls of crude found on roof and containment area due to gas bubble under the roof.	Area cleaned and seal inspected and repaired as needed.
432KT0810	12/30/10	~1.5 bbls of slop oil was found leaking from pinhole roof leak.	Area cleaned and holes were repaired using Belzona.
137TK0804	02/28/11	~3 bbls of slop oil was from leaking from roof seal.	Tank was isolated, emptied, degassed, cleaned and roof seal repaired.
136TK0594	05/21/11	~21 bbls of crude found on roof from release of hot material to the tank that burped seals.	Area cleaned and seal inspected.
136TK0594	06/29/11	~1 bbls of crude found on roof from burping seals during 634 HDS upset.	Area cleaned and seal inspected.
136TK0594	08/02/11	~3.5 bbls of crude found on roof from burping seals during 634 HDS shutdown.	Area cleaned and seal inspected.
138TK0892	09/10/11	~1 gal of Grade A crude found on roof from pinhole leak.	Area cleaned and holes were repaired using Belzona.
136TK0597	01/11/12	Internal roof drain piping failed causing a release of ~20 bbls of VGO from roof drain.	Area cleaned and roof drain piping were repaired/replaced
138TK0893	02/05/12	~ 2 gal of Grade A crude was found leaking from roof drain due to pinhole roof leaks.	Tank was isolated, emptied, degassed, cleaned and tank roof repaired by IUP.
135TK0565	07/01/12	~10 gal of gasoline was found leaking from roof drain due to faulty gasket on hatch.	Area cleaned and hatch gasket was replaced.
138TK0892	08/08/12	~3 gal of Grade A crude was found on roof from pinhole leak.	Tank was placed on DOR pending repair of 138TK0893
135TK0573	11/03/12	~5 gal of kerosene was found leaking from roof drain.	No product visible on roof so source is undetermined
136TK0583	11/20/12	~3 bbls of VGO was found leaking from roof drain.	Area cleaned and seal inspected.
136TK0582	12/07/12	~4 bbls of LSVGO was found on the roof.	Area cleaned and seal inspected.

Table 4-3 Historical Tank Failures (1996 – 2013)

Tank No.	Date	Root Cause	Actions Taken
135TK0577	01/03/13	~1 gal of gasoline was found coming from in the roof drain just after tank was returned to service.	Roof drain was blocked in and maintenance is troubleshooting cause.
136TK0582	02/18/13	~2 bbls of HVGO was found on roof.	Area cleaned and seal inspected.
135TK0576	10/04/13	~35 gal of Raffinate was found on the roof and coming from the roof drain.	The roof and area was cleaned and was seal inspected.
136TK0583	11/04/13	~20 gal of LSVGO was found leaking from roof drain.	No product visible on roof so source is undetermined
136TK0583	12/18/13	~1.3 bbls of LSVGO was found on the roof and coming from the roof drain.	The roof and area was cleaned and was seal inspected.
136TK0597	12/24/13	~1 bbl of LSVGO was found leaking from the roof drain	Area cleaned and seal inspected.

Table 5-1 Response Options for Substances with Properties Similar to Oil

Mechanism	River Bank	Man-Made Shore	Dredge Spoil Bank	Marsh
Protection Booms/Skimbers Ditches/dikes Herding	P O O	P O	P O O	P O
Cleaning/Mixing Burning Mixing Natural Cleaning	X P	X P	 O P	XX P
Removal/Disposal Manual Removal Mechanical Removal Vacuum Pumping Vegetation Cropping	P O O	 O	O O	XX XX O X
Onshore Dispersion Dispersants (on shore)** High-pressure flushing Low-pressure flushing Sand Blasting Steam Cleaning	 O	 O O P O O		O XX P XX
<p>P = Preferred</p> <p>O = Optional</p> <p>X = Not advisable</p> <p>XX = Avoid</p> <p>* Texas Water Commission, Spill Response Map Series, Coastal Region</p> <p>** A federal on-scene coordinator may authorize dispersant use only with the concurrence of all members of the EPA Region VI Response Team</p>				

Table 5-2 Oil Spill Protection Response Options

Response options	Protection Clean-up Technique	Description	Primary Use of Clean-up Technique	Technique Requirements	Biological Effect of Use
PROTECTION	Exclusion Booms	Boom is deployed across or around sensitive area and anchored in place	Use where the currents are less than 1 knot and breaking waves are	Access by boat. Access by vehicle requires good trafficability.	Minor disturbance of area
	Diversion Booms	Boom is deployed at an angle to the approaching oil. Oil is diverted away from the sensitive area to a less sensitive area for recovery.	Use where the current is greater than 1 knot and the breaking waves are less than 25 cm	Access by boat. Access by vehicle requires good trafficability.	Minor disturbances at shoreline anchor points but will cause heavy oil contamination on the down stream side
	Sorbent Booms and Barriers	Anchor along a shoreline as described above to protect sensitive areas and absorb oil	Used on quiet waters with minor oil contamination	Access by boat. Access by vehicle requires good trafficability.	Minor disturbance to shoreline at the anchor points
	Ditches and Dikes	Construct berms from tidal material to protect tidal flat areas accessible and can support earth moving equipment	Use where booms cannot be deployed. Prevent oil from reaching backshore areas during one to two tidal cycles	Heavy equipment access. Fair to good trafficability.	Major disturbance of shoreline and vegetation
	Herdng	Use low pressure water or propeller backwash to move or "herd" oil to a collection point. The protection boom remains stationary	Use in quiet waters where the current is too slow to move oil to a common collection point.	Access by boat. Access by vehicle requires good trafficability.	Minor disturbance of the area, but exercise care to prevent pushing oil under the protective boom.
CLEANING/ MIXING	Burning	Not advised	Not advised	Not advised	Kills surface organisms caught in burn area.
	Mixing	Tractor pulls discing equipment along contaminated area	Used on non-recreational sand or gravel beaches that are lightly contaminated	Heavy equipment access. Fair to good trafficability. High energy environment	Disturbs shallow burrowing organisms. Possible toxic effects from buried oil.
	Natural Cleaning	No action taken. Oil left to degrade naturally. Nutrients and microbes may be sprayed over the area to accelerate biological degradation of the oil. Used for slight oil contamination in muddy tidal flats and marsh areas where trafficability is very poor and boat access is limited.	Limited access for equipment and boats	Minimal disturbance, but potential toxic effects and smothering by the oil.	Potential elimination of habitat if organisms will not settle on residual oil.
REMOVAL/ DISPOSAL	Manual Removal	Oiled sediments and debris are removed by hand, shovels, rakes, and wheelbarrows. Apply Sorbent pads to soak up oil.	Used on mud and sand beaches when oil contamination is light or sporadic and oil penetration is slight or on beaches where access for heavy equipment is not available.	Foot or light vehicular access. Sorbent pads can be applied from a boat.	Removes and disturbs shallow burrowing organisms. Rapid recovery.

Table 5-2 Oil Spill Protection Response Options

Response options	Protection Clean-up Technique	Description	Primary Use of Clean-up Technique	Technique Requirements	Biological Effect of Use
	Mechanical Removal	Oiled sediments and debris are removed with various types of heavy equipment, i.e., backhoe, front end loader, bulldozer, etc.	Used on sand beaches or where oiled vegetation needs removal	Good trafficability. Heavy to light equipment access.	Removes shallow burrowing organisms. Severe disturbance of the surface and vegetation.
	Vacuum Pumping	Truck is backed up to oil pool or recovery site where oil is picked up via the vacuum hose.	Used to pick up oil on shorelines where pools of oil have formed in either natural depressions or where trapped by deployed exclusion or diversion booms	Heavy equipment access. Large enough pools on land or thick enough oil on water for technique to be effective. Sorbent pads may be needed to remove remaining residual vacuum truck cannot pick up.	Removal of some organisms. Potential for longer-term toxic effects associated with oil left on the land or in the water.
	Vegetation Cropping	Oiled vegetation is cut by hand, collected and stuffed into bags or containers for disposal.	Used on oil contaminated vegetation.	Foot or boat access. Cutting tools	Removes and crushes some organisms. Rapid recovery if foot traffic is minimized.
ONSHORE DISPERSION	Dispersants on shore)	A federal on-scene coordinator may authorize dispersant use only with the concurrence of all members of the Region VI Regional Response Team			
	High-Pressure Flushing	High pressure water streams remove oil from substrate where it is channeled to recovery area.	Used to remove oil coatings from rip rap, concrete and manmade structures	Light vehicular access. Recovery equipment.	Removes some organisms and shells from the substrate, damage to remaining organisms variable. Oil not recovered can be toxic to organisms downslope of cleanup activities.
	Low-Pressure Flushing	Low Pressure water spray flushes oil from substrate where it is channeled to recovery points.	Used to flush light oils that are not sticky from lightly contaminated rip- rap, concrete, manmade structures and vegetation.	Leaves most organisms alive and in place. Oil not recovered can be toxic to organisms downslope of cleanup.	
	Sand Blasting	Sand moving at high velocity removes oil from substrate.	Used to remove thin accumulations of oil residue from manmade structures.	Light vehicular access. Oil must be semi-solid. Supply of clean sand.	Removes all organisms and shells from the substrate. Oil not recovered can be toxic to organisms downslope of cleanup activities.
	Steam Cleaning	Steam removes oil from substrate where it is channeled to recovery area.	Used to remove oil coatings from rip rap, rocks, concrete and manmade structures.	Light vehicular access. Recovery equipment. Fresh water supply.	Removes some organisms from substrate but mortality due to the heat is more likely. Oil not recovered can be toxic to organisms downslope of cleanup activities.

Reference: This Information from the "Manual of Practice for Protection and Cleanup of Shorelines"; Volumes 1 and 2; U.S. EPA Document No. EPA-600/7-79-187a and b. August 1979.

Figure 5-3 Waste Transporters and Disposal Facilities

Waste Transporters	
Transporter Name	EPA Transporter ID
Safety Kleen	ILD051060408
Safety Kleen	TXD982290140
Republic Industries	TXR000015701
Garner Environmental Services, Inc.	TXD981055163
Tri-State Motor Transit	MOD095038998
Bayou City Environmental	TXR000043539

Class 1 and Class 2 Waste Disposal Facilities	
Facility Name and Site Address	EPA ID Number
BFI - Gulf West 2601 S. Jenkins Road Anahuac, TX 77514	TXD980864078
BFI – McCarty 11013 Old Beaumont Highway Houston, TX 77078	TXD000618538

Figure 5-3 Waste Transporters and Disposal Facilities, continued

Hazardous Waste Disposal Facilities	
Facility Name and Site Address	EPA ID Number
Veolia Highway 73 Port Arthur, TX 77640	TXD000838896
Safety-Kleen Corporation 3333 Federal Street Pasadena, TX 77504	TXD000747386
Texas Ecologist, Inc. Petronile Road, 4 miles south of Robstown Robstown, TX 78380	TXD069452340
Philip Reclamation Services, Houston 4050 Homestead Road Houston, TX 77028	TXD074196338
Envirotrol 118 Park Place Darlington, PA	PAD987270728
Safety Kleen (La Porte), Inc. 500 Battleground Road La Porte, TX 77571	TXD982290140
CRI 100 American Blvd. La Fayette, LA 70502	LAD980622161

Table 5-4 Location of Environmentally Sensitive Areas

Classification	Ship Channel Location	Diversion Boom Length (ft)
MARSHES, TIDAL FLATS AND BAY MARGINS (9,3,4,7)*	UP CHANNEL	
	Sims Bayou - at the LCR docks	900
	DOWN CHANNEL	
	Hunting Bayou - 1400 yds outbound of Green Beacon 161	1,350
	Greens Bayou - Red Beacon 152	1,575
	Boggy Bayou Basin - 1000 yds outbound of Green Beacon 145 at Shell Refining	2,250
	Patrick Bayou - 500 yds outbound of Green Beacon 139	2,250
	Carpenter Bayou - at Red Beacon 132 at Battleship Texas	1,350
	Old River - at Red Beacon 130 and 128	4,050
	San Jacinto River at the Lynchburg Ferry Crossing	1,800
Priority A	TOTAL =	15,525
	Burnet Bay	10,350
	Crystal Bay	5,400
	Scott Bay	16,650
	Santa Anna Bayou at Green Beacon 121	6,750
	Upper San Jacinto Bay	4,050
	Alexander Island - inbound of the Baytown Tunnel	4,950
Priority B	TOTAL =	48,150
RIVER BANKS (5)	UP CHANNEL	
	Buffalo Bayou at the Turning Basin	900
	Brays Bayou at Brad Island	2,250
	DOWN CHANNEL	
	none	
Priority C	TOTAL =	3,150
DREDGE SPOIL BANKS (8)	UP CHANNEL	
	none	
	DOWN CHANNEL	
	Alexander Island - inbound of the Baytown Tunnel on west side	22,500
	Goat Islands – between Alexander Island and the Lynchburg Ferry Crossing	4,500
Priority B	TOTAL =	27,000

*Numbers in parenthesis correspond to numbers on Figure 5-1 and 5-2 for Coastal Sensitivity Index.

Table 5-5 Federally Endangered Species – Harris County, TX

Species	Species Description	Habitat	Comments
American Alligator	A large lizard-like reptile with a broadly rounded snout. General adult coloration is grayish-black.	Broad river valleys, meandering streams, oxbow lakes, marshes, swamps, estuaries, bayous, and creeks with minimal water flow.	Currently occur in more than 90% of their historic range. They also occur in suitable inland habitat.
Artic Peregrine Falcon	Artic Peregrine Falcons are salty gray above and whitish below, and have a black head with vertical "bandit's mask" pattern over the eyes. This falcon can be distinguished from the American peregrine falcon by its smaller size and lighter coloration. They are very adept and exceedingly fast flyers, reaching speeds of more than 200 mph in dives. The dark brown or blue-gray backs of peregrines distinguish them from the sandy brown prairie falcon.	Nests in the Artic tundra. Winters in the United States, Central and South America, especially along coastlines and in mountains.	Occurs statewide in Texas during the fall and spring migrations, with a few wintering along the Texas Gulf Coast. Concentrates in April and October on North and South Padre Islands.
Whooping Crane	A large, snowy white, long necked bird with long legs that normally trail behind in flight, black primary feathers, a red crown, and wedge-shaped patch of black feathers behind the eye.	Marshes, river bottoms, potholes, prairies, cropland. Whooping cranes feed on small grains in agricultural fields, green forage, aquatic plants, insects, crustaceans and small vertebrate animals.	
Least Tern	Small birds (21 cm long) black crown, white forehead, grayish back and dorsal wing surfaces, jet black wing tips, snowy white under parts, and a black-tipped yellow bill. The male's bill is orange to bright yellow and the female's is light or dull yellow or straw-colored.	Premier nesting sites are salt flats, broad sandbars, and barren shores along wide, shallow rivers. Vegetation, if present, is usually located well away from the colony, with the exception of bugseed, eastern cottonwood and sandbar willow. As natural nesting sites have become sparse, birds have used dredge islands, dike fields, fly-ash lagoons, sandpits, and gravel levee roads as nesting sites.	Occur as remnant colonies within their historic distribution. Winters along the Gulf Coast.
Piping Plover	NO DATA IN ACP		
Bald Eagle	A large eagle with white head and tail in adult, wingspan 6 to 7.5 ft. Tarsi are bar of feathers. Juveniles are dark or mottled.	Nests near water; requires large trees for nesting. Winters along major rivers and reservoirs, and occasionally in rangeland areas. Fish, waterfowl and carrion are the primary food sources.	Counties shown as present distribution are those that contain large wintering population. Winter concentrations occur around large bodies of water from December to March.
Texas Prairie Dawn-Flower	A small single-stemmed or branching annual reaching a height of up to 6 inches. Leaves clustered at the plant base are spoon-shaped. Stem leaves are alternate, narrow with parallel sides, and no or few teeth on the margin. Seeds are cone-shaped, obscurely 4-angled, and hairy.	Occurs in sparsely vegetated areas of fine- sandy compacted soil. These mostly barren areas are sparsely vegetated and the soil is often covered with a blue-green alga. It can also occur on disturbed soils such as rice fields, vacant lots, and pastures if the soil structure remains relatively intact.	

Reference: U.S. Environmental Protection Agency. 1994. EPA Region VI Inland Area Contingency Plan - Texas. EPA-540/R-94/048. Annex F, Appendix V, I., pg 109-110.

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
Acenaphthene		100		83-32-9
Acenaphthylene		5000		208-96-8
Acetone	2-Propanone	5000		67-64-1
Acetylene	Ethyne		100	74-86-2
Ammonia (Anhydrous)		100		7664-41-7
Anthracene		5000		120-12-7
Asbestos (Friable)		1		1332-21-4
Benzene		10		71-43-2
Benz[a]anthracene	1,2-Benzanthracene	10		56-55-3
Benzo[a]pyrene	3,4-Benzopyrene	1		50-32-8
Benzo[b]fluoranthene		1		205-99-2
Benzo(k)fluoranthene		5000		207-08-9
Benzo[j,k]fluorene	Fluoranthene	100		206-44-0
1,2-Benzphenanthrene	Chrysene	100		218-01-9
1,3-Butadiene		10		106-99-0
Butane			5000	106-97-8
Butanes (any isomer)			5000	
1-Butanethiol	n-Butyl Mercaptan		100	109-79-5
2-Butanone	Methyl Ethyl Ketone	5000		78-93-3
1-Butene			100	106-89-9
2-Butene (cis)			100	590-18-1
2-Butene (trans)			100	624-64-6
Butenes (any isomer, except 1,3 butadiene)			100	
n-Butyl Mercaptan	1-Butanethiol		100	109-79-5
Cadmium		10		7440-43-9

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
Carbon Dioxide		NONE	NONE	124-38-9
Carbon Disulfide		100		75-15-0
Carbon Monoxide			5000	630-08-0
Carbonyl Sulfide		100		463-58-1
Chlorine		10		7782-50-5
Chromium		5000		7440-47-3
Chrysene	1,2-Benzphenanthrene	100		218-01-9
Creosols (isomers and mixture)	Cresylic Acid (isomers and mixture)	100		1319-77-3
<i>m</i> -Cresol	<i>m</i> -Cresylic acid	100		108-39-4
<i>o</i> -Cresol	<i>o</i> -Cresylic acid	100		95-48-7
<i>p</i> -Cresol	<i>p</i> -Cresylic acid	100		106-44-5
Cumene	Isopropylbenzene	5000		98-82-8
Cyclohexane		1000		110-82-7
Cyclopentane			100	287-92-3
Decanes (any isomer)			5000	
Dibenz[a,h]anthracene		1		53-70-3
1,2-Dichloroethane	Ethylene Dichloride	100		107-06-2
Diethanolamine (DEA)		100		111-42-2
Diethyl Sulphide			100	352-93-2
Diethylamine		100		109-89-7
Diglycolamine (DGA)			100	929-06-6
2,2-Dimethyl Butane			5000	75-83-2
2,3-Dimethyl Butane			5000	79-29-8
2,2-Dimethyl Cyclohexane			100	590-66-9

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
2,4-Dimethyl Cyclohexane			100	
1,1-Dimethyl Cyclopentane			100	1638-26-2
1,3-Dimethyl Cyclopentane			100	2453-00-1
1,2-Dimethyl Cyclopentane (trans)			100	822-50-4
1,3-Dimethyl Cyclopentane (trans)			100	1759-58-6
2,5-Dimethyl Hexane			5000	592-13-2
2,2-Dimethyl Pentane			100	590-35-2
2,3-Dimethyl Pentane			100	565-59-3
2,4-Dimethyl Pentane			100	108-08-7
3,3-Dimethyl Pentane			100	562-49-2
Dimethyl Sulphide			100	75-18-3
Dimethyl Disulphide			100	624-92-0
Dimethylamine	Methanamine, N-Methyl-	1000		124-40-3
Ethane		NONE	NONE	74-84-0
Ethanol	Ethyl Alcohol		5000	
Ethyl Cyclopentane			100	1640-89-7
Ethyl Mercaptan			100	74-93-1
Ethyl tertiary-Butyl Ether (ETBE)			100	637-92-3
Ethylbenzene		1000		100-41-4
Ethylene			100	74-85-1
Ethylenediamine		5000		107-15-3
Ethylenediamine-tetraacetic Acid (EDTA)		5000		106-93-4
Ethylene Dichloride	1,2-Dichloroethane	100		107-06-2
Ethylene Glycol		5000		107-21-1
3-Ethyl Pentane			100	617-78-7

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
Ethyne	Acetylene		100	74-86-2
Fluoranthene	Benzo[j,k]fluorene	100		206-44-0
Fluorene		5000		86-73-7
Heptane			100	142-82-5
Hexane		5000		110-54-3
Hexanes (any isomers)			5000	
Hydrochloric Acid	Hydrogen chloride	5000		7647-01-0
Hydrogen		NONE	NONE	1333-74-0
Hydrogen Sulfide		100		
Indeno(1,2,3-cd)pyrene		100		193-39-5
Isobutane			5000	75-28-5
Isobutene			5000	115-11-7
Isobutyl Alcohol	1-Propanol, 2-methyl-	5000		78-83-1
Isobutylene			5000	
Isopentane			5000	
Isoprene		100		78-79-5
Isopropyl Alcohol			5000	
Isopropyl Mercaptan			100	75-33-2
Isopropylbenzene	Cumene	5000		98-82-8
Lead		10		7439-92-1
m-Xylene	1,3-Dimethyl Benzene	1000		108-38-3
Mercury		1		7439-97-6
Methane		NONE	NONE	74-82-8
Methanol	Methyl Alcohol	5000		67-56-1
2-Methyl Butene-1			100	563-46-2

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
2-Methyl Butene-2			100	513-35-9
3-Methyl Butene-1			100	563-45-1
3-Methyl Butene-2			100	513-34-8
Methyl tert-Butyl Ether		1000		1634-04-4
Methyl Cyclohexane			100	108-87-2
Methyl Cyclopentane			100	96-37-7
Methyl Diethanolamine (MDEA)			100	105-59-9
Methyl Ethyl Ketone (MEK)	2-Butanone	5000		78-93-3
2-Methyl Hexane			100	591-78-4
3-Methyl Hexane			100	589-34-4
Methylmercaptan		100		74-93-1
2-Methylnaphthalene				
2-Methyl Pentane			5000	107-83-5
3-Methyl Pentane			5000	96-14-0
Naphthalene		100		91-20-3
Neopentane			5000	463-82-1
Nickel		100		7440-02-0
Nickel Carbonyl		10		13463-39-3
Nitric Acid (>=80% For CAA 112®)		1000		7697-37-2
Nitric Oxide (Nitrogen Oxide)		10	100	10102-43-9
Nitrogen Dioxide		10	100	10102-44-0
Nonane			100	111-82-4
n-Butyl Mercaptan	1-Butanethiol		100	109-79-5
n-Pentyl Mercaptan			100	110-66-7
n-Propyl Benzene			100	103-65-1

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
n-Propyl Mercaptan			100	107-03-9
<i>o</i> -Xylene	1,2-Dimethyl Benzene	1000		95-47-6
Octane			5000	111-65-4
Octanes (any isomer)			5000	
Oxygen		NONE	NONE	7782-44-7
<i>p</i> -Xylene	1,4-Dimethyl Benzene	100		106-42-3
1,3-Pentadiene	1-Methylbutadiene	100		504-60-9
Pentane			5000	109-66-0
Pentanes (any isomer)			5000	
1-Pentene			100	109-67-1
2-Pentene (cis)			100	627-20-3
2-Pentene (trans)			100	645-04-8
n-Pentyl Mercaptan			100	110-66-7
Phenanthrene		5000		85-01-8
Phenol	Hydroxy-Benzene	1000		108-95-2
Phosphoric Acid		5000		7664-38-2
Polychlorinated Biphenyls (PCBS)		1		1336-36-3
Potassium Hydroxide		1000		1310-58-3
Propadiene			100	463-49-0
Propane			5000	74-98-6
1-Propanol, 2-methyl-	Isobutyl Alcohol	5000		78-83-1
2-Propanone	Acetone	5000		67-64-1
n-Propyl Benzene			100	103-65-1
n-Propyl Mercaptan			100	107-03-9
Propylene			100	115-07-1

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
Propyne	Methyl Acetylene		100	74-99-7
Pyrene		5000		129-00-0
Radionuclides (Including Radon)		1		
Sodium Hydroxide		1000		1310-73-2
Sodium Phosphate, Dibasic		5000		7558-79-4
Sodium Phosphate, Tribasic		5000		7601-54-9
Styrene		1000		100-42-5
Sulfolane			100	126-33-0
Sulfur Dioxide		500		
Sulfur Trioxide		100		
Sulfuric Acid		1000		
Tertiary Butyl Mercaptan			100	75-66-1
tertiary-Amyl Methyl Ether (TAME)			100	994-05-8
tertiary-Butyl Alcohol (Arconol)			100	75-65-0
Tetraethyl Lead		10		78-00-2
Thiophene			100	110-02-1
Toluene		1000	100	108-88-3
1,1,1,-Trichloro Ethane	Methyl Chloroform	1000		71-55-6
1,1,2,-Trichloro Ethane		100		79-00-5
1,3,5-Trimethyl Benzene	Mesitylene			
1, t-2,c-3 Trimethyl Cyclopentane			100	15890-40-1
1,t-2,c-4 Trimethyl Cyclopentane			100	
2,2,3-Trimethyl Butane			100	464-06-2
2,3,3-Trimethyl Pentane			5000	560-21-4
2,3,4-Trimethyl Pentane			5000	565-75-3

Table 6-1 List of Hazardous Chemicals and Reportable Quantities

Chemical Name	Synonyms	SARA/CERCLA RQ (lbs)	TCEQ RQ (lbs)	CAS Number
Xylenes (Mixed)	Dimethyl Benzene	100		1330-20-7
<i>m</i> -Xylene	1,3-Dimethyl Benzene	1000		108-38-3
<i>o</i> -Xylene	1,2-Dimethyl Benzene	1000		95-47-6
<i>p</i> -Xylene	1,4-Dimethyl Benzene	100		106-42-3
Zinc		1000		7440-66-6
Zinc Chloride, Anhydrous		1000		7646-85-7

Table 6-2 Hazardous Waste Classification

Classification	SARA/CERCLA RQ (lbs)
D001 – Flammable	100
D002 – Ignitable	100
D003 – Corrosive	100
F037 – Petroleum Refinery Primary Sludge	1
F038 – Petroleum Refinery	1
K049 – Slop oil emulsion solids from the petroleum refining industry.	10
K050 – Heat exchanger bundle cleaning sludge from the petroleum refining industry	10
K051 – API separator sludge from the petroleum refining industry.	10
K052 – Tank bottoms (leaded) from the petroleum refining industry.	10
K169 – Crude oil storage tank sediment from petroleum refining operations.	10
K171 – Spent hydrotreating catalyst from petroleum refining operations.	1

EMERGENCY RESPONSE ACTION PLAN

[Facility Information](#)

[Qualified Individuals – Internal Notifications](#)

[Emergency Response Command Structure](#)

[Emergency Operations Structure](#)

[External Notifications](#)

[Notification Form](#)

[Emergency Response Equipment](#)

[Facility Evacuation Plan](#)

[Facility Diagram](#)

Immediate Actions - Emergency Procedures

[HSE-EAP-002 Emergency Notification and Response](#)

[HSE-EAP-003 Evacuation and Personnel Accounting](#)

[HSE-EAP-007 Incident Command Structure and Organization](#)

[HSE-EAP-008 Communications](#)

[HSE-EAP-010 Outside Resources and Mutual Aid](#)

Emergency Response Safety Plan

[Level I Site Safety Plan Template](#)

[Level II Site Safety Plan Template](#)

FACILITY INFORMATIONLast Update Date: February 22, 2013Main Office Name: Houston Refining LPStreet Address: 12000 Lawndale St.City: Houston State: Texas Zip: 77017-2740

Mailing Address (if different from above):

Street Address: PO Box 2451City: Houston State: Texas Zip: 77252-2451County: Harris Phone Number: (713) 321-4111Facsimile Number: 713.321.6820 (HSSE) or 713.321.6835 (PSS)Latitude: (b) (7)(F), (b) (3)

Longitude

(b) (7)(F), (b) (3)NCP Response Zone: _____ Inland: X CoastalOwner: Houston Refining LPOwner Address: same (If different from facility address)Owner Facility's Contract: Todd Monette Phone Number: 713.321.4111Street Address: 12000 LawndaleCity: Houston State: Texas Zip: 77017-2740**Qualified Individual:**Name: Plant Shift SuperintendentPosition: This person at the refinery 24/7 and is a shift position covered by 5 peopleAddress: 12000 Lawndale, Houston, TX 77017-2740Emergency Phone Number: 713.321.4223 (PSS) or 713.321.4211 (Security Operations Ctr)Training: Annual Emergency Action Plan Review Regulatory TrainingAnnual Emergency Response Preplan MeetingAnnual (or as needed) On-Scene Incident Command TrainingUnannounced Drills

FACILITY INFORMATION, continued

EPA FRP ID Number: FRP-06-TX-00040
Primary SIC Code: 2911 (Petroleum Refining)
Primary NAICS Code: 324110 (Petroleum Refining)
Dun & Bradstreet Number: 80--63-2-22 (DUNS Number)

Dates and Types of Substantial Expansions: Under operation by Sinclair, the refinery's 732 Fluidized Catalytic Cracking Unit (FCCU) and the 630/631 Hydrodesulfurization (HDS) units were commissioned in 1953 and 1958, respectively. In the early 1960s, the Lubes Complex was constructed for processing Grade A naphthenic crude oil and select feedstocks to produce several grades of white oils and lubricating oils. When Sinclair merged with ARCO in 1969, the 736 Coker was commissioned. In 1976, a major expansion of the refining occurred which included commissioning of the 230 Gas Plant, 633 HDS, 634 HDS, 635 HDS, 433 Claus, 434 Claus, 435 Tail Gas Unit, and 536 Crude. Just after the formation of Lyondell-CITGO Refining, another major expansion of the refining occurred in 1996/97 which included commissioning of the 439 Claus, 440 Tail Gas Unit, 636 HDS, 537 Crude, and 737 Coker. Following this last major expansion, the 637 HDS was placed into service in 2006 to meet ultra-low sulfur standards, and the 433 and 434 Claus were completely rebuilt with O₂ enrichment in 2011 and 2012, respectively.

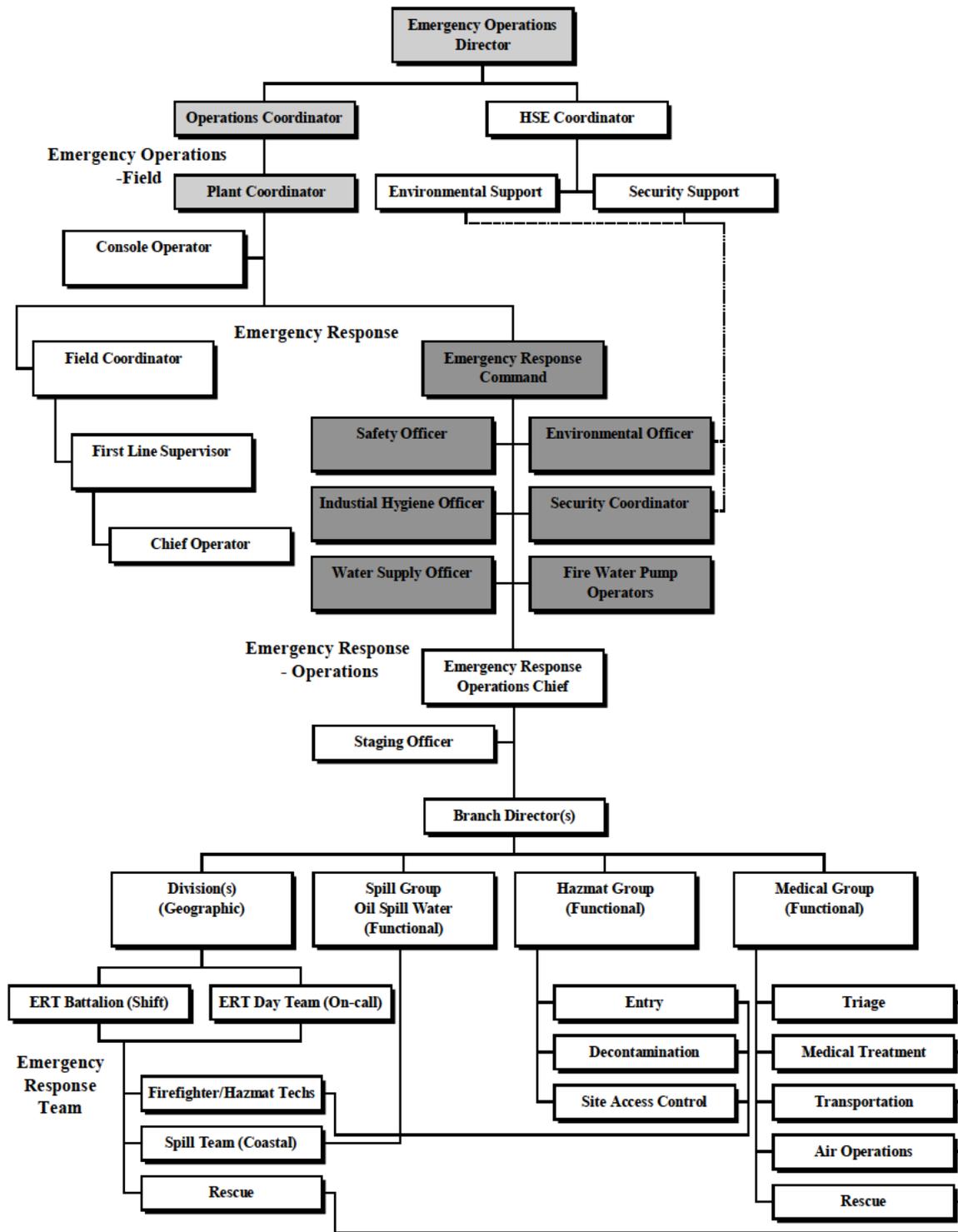
QUALIFIED INDIVIDUALS - INTERNAL NOTIFICATIONS

INTERNAL NOTIFICATIONS - GENERAL FACILITY			
FACILITY	ADDRESS	OFFICE	FAX NUMBER
Houston Refining LP	12000 Lawndale Houston, Texas 77252-2451	713-321-4111 713-321-4211 (SOC)	713-321-4700

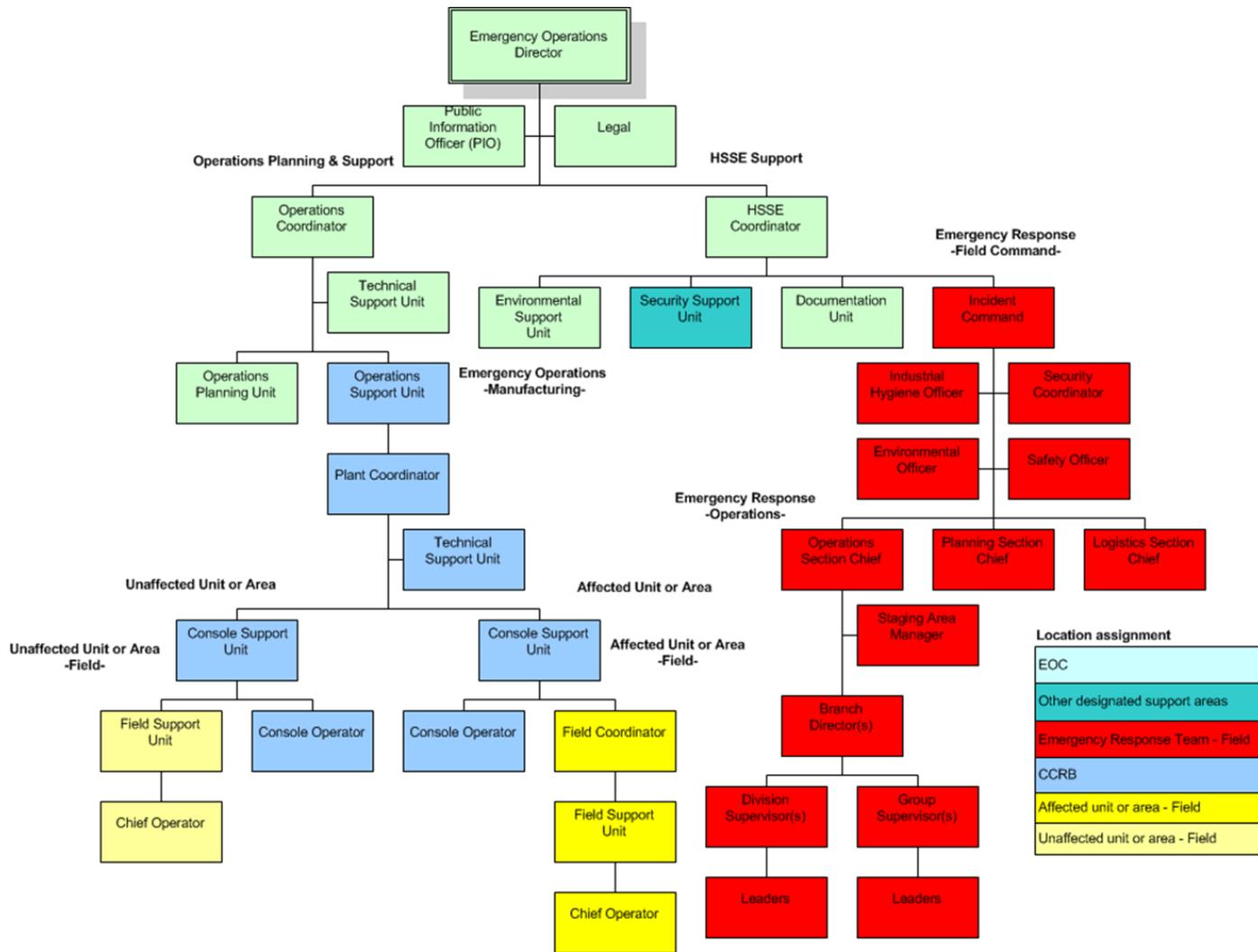
INTERNAL NOTIFICATIONS - LOCAL RESPONSE TEAM				
POSITION/TITLE	RESPONSE TIME	TRAINING LEVEL	CONTACT NUMBER	SPILL EVENT RESPONSIBILITY
Plant Shift Superintendent / QI*	Immediate 1-On Duty/Shift On-Site 24/7	HAZWOPER Operations Level Plant/Field Coord. Training (Includes QI Training)	713-321-4223 – Office 713-321-4211 – SOC	Plant Coordinator
First Line Supervisor /QI*	Immediate 1 -On Duty/Shift On-Site 24/7	HAZWOPER Operations Level Plant/Field Coord. Training (Includes QI Training)	713-321-4211 – SOC	Field Coordinator
Emergency Response Team (ERT) - Officers* Shift Commander and other ERT Officers	Immediate 1 On Duty/Shift On-Site 24/7	HAZWOPER Incident Command Level	713-321-4211 – SOC	Shift Commander (Incident Command) Other officers ICS positions as required.
Chief Officers: Chief Assistant Chief	Respond To Callout When Not On Shift	HAZWOPER Incident Command Level	713-321-4211 – SOC	Incident Command or other ICS positions as required
Emergency Response Team (ERT)	Immediate 10 - On Duty/Shift On-Site 24/7 Respond To Callout When Not On Shift	HAZWOPER Hazmat Tech Level Firefighter/Hazmat Techs	713-321-4211 – SOC	Emergency response services to include supporting Marine Spill Team
ERT Marine Spill Team Personnel	Immediate 3 - On Duty/Shift On-Site 24/7 Respond To Callout When Not On Shift	HAZWOPER Hazmat Tech Level Firefighter/Hazmat Techs	713-321-4211 – SOC	Emergency marine spill response

* All of these positions are manned 24 hours per day, and any of these personnel can be reached through SOC at (713) 321-4211 at any time. Other specific training for individuals is maintained at the facility.

EMERGENCY RESPONSE – COMMAND STRUCTURE



EMERGENCY OPERATIONS STRUCTURE



Location assignment	
EOC	Unaffected unit or area - Field
Other designated support areas	Affected unit or area - Field
Emergency Response Team - Field	Unaffected unit or area - Field
CCRB	Affected unit or area - Field
Affected unit or area - Field	Unaffected unit or area - Field
Unaffected unit or area - Field	Affected unit or area - Field

EXTERNAL NOTIFICATIONS

GOVERNMENTAL EMERGENCY NOTIFICATION/ADVISORY (CALL 911 IN CASE OF EMERGENCY)			
Service	Location	Office	Alternate
City of Houston Municipal Water Supply	Houston, TX	(713) 837-0311	
City of Pasadena Fire Department	Pasadena, TX	(713) 473-2273	
City of Pasadena LEPC	Pasadena, TX	(713) 473-2273	
City of Pasadena Ambulance Service	Pasadena, TX	(713) 472-1911	
City of Pasadena Water Department	Pasadena, TX	(713) 475-5566	
City of Pasadena Fire Marshal's Office	Pasadena, TX	(713) 475-5556	
City of Pasadena City Marshal's Office	Pasadena, TX	(713) 475-5559	
F.B.I. – Houston	Houston, TX	(713) 693-5000	
Gulf Coast Authority – Washburn Tunnel Facility	Pasadena, TX	(713) 472-5507	(713) 648-2373 (pager for Greg Seay)
Harris County Sheriff	Houston, TX	(713) 221-6000	
Texas Commission on Environmental Quality	Houston, TX	(713) 767-3563	(713) 767-3561 (fax)
National Response Center (NRC)	Washington, DC	(800) 424-8802	
Texas Department of Public Safety	Houston, TX	(281) 517-1300	
Texas General Land Office	La Porte, TX	(800) 832-8224	

OUTSIDE ASSISTANCE/ADVISORY NOTIFICATIONS			
Company	Location	Office	Alternate
CenterPoint Energy	Houston, TX	(281) 894-0491	
Southwestern Bell Telephone Company	Houston, TX	(800) 286-8343	
KHOU – TV (CBS)	Houston, TX	(713) 521-4384	
KPRC – TV (NBC)	Houston, TX	(713) 778-4910	
KTRK – TV (ABC)	Houston, TX	(713) 666-0713	
KRIV – TV (FOX)	Houston, TX	(713) 479-2600	
KTRH Radio	Houston, TX	(713) 212-8000	
KPRC Radio	Houston, TX	(713) 212-8000	
KILT Radio	Houston, TX	(713) 881-5170	
Infinity Radio Houston (KILT)	Houston, TX	(713) 881-5957	
Weather Report	Houston, TX	(281) 337-5074	

EXTERNAL NOTIFICATIONS, continued

LOCAL MEDICAL EMERGENCY SERVICES			
Service	Location	Office	Alternate
Rural/Metro Ambulance	Pasadena, TX	(713) 472-1911	
Columbia Bayshore Medical Center	Pasadena, TX	(713) 359-1440	
Memorial Hermann Southeast	Pasadena, TX	(281) 929-6100	
Kindred Hospital	Pasadena, TX	(713) 473-9700	
Hermann Hospital	Houston, TX	(713) 704-4000	(713) 704-7284

WILDLIFE ASSISTANCE/ADVISORY NOTIFICATIONS			
Company	Location	Office	Alternate
Wildlife Center of Texas (24 Hrs) (Sharon Schmalz)	League City, TX	(281) 332-8319	(713) 279-1417 (Pager) (713) 643-9453 (Menu)
Texas Parks & Wildlife Department (24 Hrs) (Law Enforcement Center)	La Porte, TX	(281) 842-8100	(281) 842-8404 (Fax)
Texas Parks & Wildlife Department (Local Field Office - South)	Houston, TX	(713) 779-8977	(713) 779-7742 (Fax) (281) 931-6471 (North)
U.S. Fish and Wildlife Service (Ron Brinkley)	Houston, TX	(281) 286-8282	(281) 488-5882 (b) (6) (Cell)

USCG CLASSIFIED OIL SPILL REMOVAL ORGANIZATIONS (OSRO)			
Company	Location	Office	Alternate
Garner Environmental Services, Inc.	Deer Park, TX	(800) 424-1716	(281) 930-1200
Clean Channel Association (CCA)	Houston, TX	(713) 534-6195	
Administrative Director: (Phil Glenn)	Houston, TX	(713) 534-6195	(713) 534-6197 (Fax) (b) (6) (Home) (b) (6) (Mobile)
Equipment and Maintenance Supervisor: (Steven Bigby)	Houston, TX	(713) 534-6195	(713) 534-6197 (Fax) (b) (6) (Home) (b) (6) (Mobile) Nextel ID: 142*54*11950
Administrative Assistant: (Karen Storm)	Houston, TX	(713) 534-6195	(713) 534-6197 (Fax) (b) (6) (Home) (b) (6) (Mobile)



Facility Response Plan
Emergency Response Action Plan

NOTIFICATION FORM

Notification Data Sheet		
Date: _____		Time: _____
INCIDENT DESCRIPTION		
Reporter's Full Name: _____		Position: _____
Day Phone Number: _____		Evening Phone Number: _____
Company: _____		Organization Type: _____
Facility Address: _____		Owner's Address: _____
_____		_____
Facility Latitude: _____		Facility Longitude: _____
Spill Location: _____		
(if not at Facility) _____		
Responsible Party's Name: _____		Phone Number: _____
Responsible Party's Address: _____		
Source and/or cause of discharge: _____		

Nearest City: _____		
County: _____	State: _____	Zip Code: _____
Section: _____	Township: _____	Range: _____
Distance from City: _____		Direction from City: _____
Container Type: _____		Container Storage Capacity: _____
Facility Oil Storage Capacity: _____		
Material:		
Total Quantity Released	Water Impact (YES or NO)	Quantity into Water
Weather conditions on scene: _____		
RESPONSE ACTION(S)		
Action(s) taken to Correct, Control, or Mitigate Incident: _____		

Number of Injuries: _____		Number of Deaths: _____
Evacuation(s): _____		Number Evacuated: _____
Damage Estimate: _____		
More information about impacted medium: _____		

CALLER NOTIFICATIONS		
National Response Center (NRC): 1-800-424-8802		
Additional Notifications (Circle all applicable): USCG EPA State OSHA Other		
NRC Incident Assigned No. _____		
ADDITIONAL INFORMATION		
Any information about the incident not recorded elsewhere in this report: _____		

NOTE: DO NOT DELAY NOTIFICATION PENDING COLLECTION OF ALL INFORMATION.		

EMERGENCY RESPONSE EQUIPMENT

Equipment	Description	Operational Check	Location / accessibility
Oil Boom	1500' 18" conventional oil containment boom	Once per quarter	1250' - Spill Response Facility
Oil Boom		Once per quarter	250' - Boom Box between B and C Dock
Oil Boom		Once per quarter	250' - Boom Box between C and D Dock
Spill Boats	1-16' flat bottomed boat and 1-21' flat bottomed spill boat.	Once per quarter	16' boat located in Spill Response Facility (NE corner of refinery) and 21' boat located in No. 5 Barn
Vacuum Truck - 1989 Freightliner / Cusco, truck No. 6135	70 - barrel capacity	Trucks are used daily for various purposes.	Leased from Veolia
Vacuum Truck - 1990 International/Cusco, truck No. 3335	70 - barrel capacity	Trucks are used daily for various purposes	Leased from Veolia
Vacuum Truck - 1991 International/Cusco, truck no. 6008	70 - barrel capacity	Trucks are used daily for various purposes	Leased from Veolia
Vacuum Truck - 2002 International, truck no. 6189	Liquid Ring Ace	Trucks are used daily for various purposes	Leased from Veolia
Absorbents - Spill Textiles.	Assorted Sorbent Booms & Pads	Once per quarter	East Staging Building, Waste Crew Truck, 7 Hazmat Trailer
Absorbents	Sorbent Granules	Once per quarter	East Staging Building, Waste Crew Truck, 7 Hazmat Trailer
Power Generator	PTO-Driven	Once per quarter	Rescue Truck R-1, Cascade Truck C-1
900 MHz Motorola Radios, MTS2000 Smartnet Trunked Portable Radio, Model HOIQX/207H,	5 - Plant Frequency	Radios are used daily and replaced as needed.	HSE Communications Equipment Cabinet
Lighting	Light Towers	Once per quarter	Rescue Truck R-1, Cascade Truck C-1
Respirators - Scott SCBA Masks	50 - Small, medium, large	Once per quarter	Cascade Truck
Respirators - 4.5 Scott Ready to Use	36	Once per quarter	Cascade Truck
Ready to Use Scott Bottles	36	Once per quarter	Cascade Truck

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-002	Page: 1 OF 5	Approval Date:	06/30/2011
Document Title:	EMERGENCY NOTIFICATION & RESPONSE				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

EMERGENCY NOTIFICATION SYSTEM

The refinery Emergency Notification System (ENS) is used to advise personnel of emergency response and evacuation orders (See the [HSE-EAP-003 Evacuation and Personnel Accounting Procedure](#)).

The ENS is an integrated multi-media system designed for the purpose of communicating emergency messages to plant occupants. The system consists of tone, voice, and text messaging to a combination of sub-systems throughout the facility.

Upon notification of an emergency, the Main Gate Dispatcher activates the ENS. The ENS will provide information on the Alert level, type of emergency, location, and evacuation requirements. Additionally, the system is used to advise of any further special information. An All Clear is issued over the ENS to terminate the emergency.

The ENS may also be used to inform / notify personnel of refinery situations that they should be aware of, but do not meet the definition of an emergency (i.e., unit start ups and shut downs, adverse weather situations, etc.)

EMERGENCY CLASSIFICATION

Emergencies are classified by the level of response that is required and the type of emergency.

Responses are tiered into four alert levels. The level of a particular event is dependent on its magnitude from minor to serious. Each alert level activates emergency response groups according to predetermined response orders.

The type of emergencies may be either:

- Medical
- Rescue
- Fire
- Gas release
- Spill
- General emergency (i.e., weather event, power failure, process upset, etc.)

The Main Gate Dispatcher disseminates information provided and dispatches the appropriate level of Alert. After the initial Alert, the level may subsequently be escalated by the Plant Coordinator, the Incident Commander or the Field Coordinator.

DOCUMENT NO:	HSE-EAP-002	PAGE:	2 OF 5
DOCUMENT NAME: EMERGENCY NOTIFICATION & RESPONSE			

The tiered alert levels are defined below. General emergency management group response orders for each alert level are listed in [Appendix 1 - Response Classifications: Alert Levels](#).

ALERT 1: Medical, Rescue, Fire, Gas Release, or Spill

Minor emergency requiring only a limited emergency response. The impact of the event is contained to one source or within its area of origin. There is no potential for the incident to effect areas outside of the facility.

Examples of an Alert 1 emergency include, but may not be limited to, the following:

- Fires contained to one source or unit
- Minor spill or release which is confined within the area of origin
- Medical emergency with less than three (3) injuries or illnesses
- Malfunction or damage of radiography equipment unshielding source

ALERT 2: Medical, Rescue, Fire, Gas Release, or Spill

Emergency requiring activation of the Emergency Operations Center due to

- Actual or potential for off-site impact
- News media coverage
- The need for additional emergency management, technical or logistical support
- Significant regulatory agency involvement

Examples of an Alert 2 emergencies include, but may not be limited to, the following:

- Explosion and fire impacting more than an isolated area
- Major spill or release that is or may impact areas outside of facility
- Medical emergency with more than three (3) serious injuries or illnesses
- Incident involving a fatality
- Incident involving multiple units or buildings

ALERT 3: Medical, Rescue, Fire, Gas Release, or Spill

Emergency requiring activation of off-site emergency response team members and all emergency management support and resources.

Examples of an Alert 3 emergency include, but may not be limited to, the following:

- Major fire or explosion affecting a large area
- Fully involved fire in a large storage tank
- Major spill or release impacting areas outside of facility
- Mass casualty medical emergency
- Emergency of a long duration or other circumstances that make additional responders necessary

DOCUMENT NO:	HSE-EAP-002	PAGE:	3 OF 5
DOCUMENT NAME: EMERGENCY NOTIFICATION & RESPONSE			

ALERT 4: Medical, Rescue, Fire, Gas Release, or Spill

Emergency requiring outside mutual aid assistance and support.

An Alert 4 activates resources from Channel Industries Mutual Aid (CIMA). The Main Gate Dispatcher or Incident Commander activates the CIMA predetermined list as indicated below:

- CIMA first, second or third alarm
- CIMA Mass Casualty Incident: MCI-10, MCI-20 or MCI-30

Note that a CIMA "Special Call" does not in and of itself constitute an Alert 4 Response.

ALL CLEAR

When the emergency is over and it is safe for personnel to return to normal work activity, Main Gate Dispatch will activate the "All-Clear" via the ENS.

SRU THERMAL OXIDIZER / FLARE RELEASES

The Plant Shift Superintendent is responsible for ensuring that appropriate responses are made to SRU incinerator or flare releases.

Incinerator or flare releases, which may affect or are affecting the refinery or areas outside the plant boundaries, shall be alerted according to the alert levels described above. Those events that impact or are visible to areas outside of the refinery, should result in consideration of community notification via the CAER Line.

Effect or impact from SRU releases may be determined using known facts and observable information as follows:

- SRU Operating conditions
- H₂S and SO₂ Emissions Analyzer data
- Visual observations
- Atmospheric conditions

DOCUMENT NO:	HSE-EAP-002	PAGE:	4 OF 5
DOCUMENT NAME:			
EMERGENCY NOTIFICATION & RESPONSE			

Appendix 1 Response Classification Alert Levels

Response Classification	Type of Emergency	Response
Alert 1 Minor Emergency Limited Response	Medical	ERT Battalion Rescue Team (On-Shift) ERT Officers Medical HSE Security (On-Shift)
	Rescue	Same as Alert 1 Medical response
	Fire Gas Release Spill	ERT (On-Shift) ERT Officers HSE On-Call Personnel HSE Security (On-Shift)
	Radiation	ERT Officers HSE On-Call Personnel HSE Security (On-Shift)
Alert 2 Emergency Management Support Resources (EOC)	Medical	Alert 1 medical PLUS Emergency operations (EOC)
	Rescue	Alert 1 Rescue PLUS Emergency operations (EOC)
	Fire Gas Spill	Alert 1 Response PLUS Emergency operations (EOC) HSE (All)
	Radiation	Alert 1 Radiation Response PLUS Emergency operations (EOC)
Alert 3 All Emergency Resources	Medical Rescue	Alert 2 Response PLUS: ERT Day Team (On-Call) ERT Battalions (Off-Shift)
	Fire Gas Release Spill	
Alert 4 Mutual Aid and Outside Resources	Medical Rescue	Alert 3 Response PLUS CIMA Alarm List or MCI activation Other mutual aid as requested
	Fire Gas Release Spill	

DOCUMENT NO:	HSE-EAP-002	PAGE:	5 OF 5
DOCUMENT NAME:			
EMERGENCY NOTIFICATION & RESPONSE			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-003	Page: 1 OF 15	Approval Date:	06/30/2011
Document Title:	EVACUATION AND PERSONNEL ACCOUNTABILITY				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>			Effective Date:	07/01/2011
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>			Review Date:	02/28/2011

TABLE OF CONTENTS

Summary	2
Scope	2
Definitions	2
Roles and Responsibilities	3
Procedure	5
Evacuation	5
Reporting Accountability	5
Facility Emergency Evacuations	6
Non-Essential Personnel Evacuate the Unit / Area	6
Non-Essential Personnel Plant-Wide Report to Rally Points	7
All Personnel Evacuate the Unit / Area	7
All Personnel Plant-Wide Report to Evacuation Points	8
Supplemental Evacuation Orders	8
Communication with Evacuation Points	9
Building Fire Evacuations	10
Shelter in Place	10
Training	11
Appendix 1 - Refinery Evacuation Map	12
Appendix 2 - List of Accountability Readers and Evacuation Points	13
Appendix 3 - Special Situation Clarifications	14
Calpine Channel Energy Center	14
Personnel working at the Docks (HRO and non-HRO Personnel)	14
Personnel working in Remote Tank Farms	14
Revision Summary	15

DOCUMENT NO:	HSE-EAP-003	PAGE:	2 OF 15
DOCUMENT NAME: EVACUATION AND PERSONNEL ACCOUNTABILITY			

SUMMARY

This Evacuation and Accountability Plan provides procedures for the orderly evacuation of personnel from a unit or area affected by an emergency condition to a safe area. The plan also provides emergency accountability procedures for all personnel within the plant.

SCOPE

These Evacuation and Accountability Procedures apply to all Houston Refining, LP employees, contractors, delivery personnel and visitors within the confines and jurisdiction of the Houston Refinery. The procedures shall be followed in the event of a facility emergency or a building fire / fire alarm.

DEFINITIONS

Accountability Coordinator - Assigned persons or supervisors who manage accountability for their assigned area during a non-essential personnel evacuation of a unit / area or a Building Fire Alarm Evacuation. Some Accountability Coordinators may also serve in the Building Point Coordinator role.

Accountability Reader – An electronic badge reader specifically utilized for accountability. There is at least one Accountability Reader near each Rally Point and at each Evacuation Point. Accountability Reader locations are listed in [Appendix 2](#), are marked via signage and are shown on the Refinery Evacuation Map [Appendix 1](#).

Building Evacuation Point – The designated location(s) outside of a building to which building occupants should report in the event of a building fire or fire alarm. Building Evacuation Points for each building are shown on each respective Building Evacuation Drawing.

Building Point Coordinators – Assigned persons to which Accountability Coordinators and/or individual personnel report that they have evacuated the building during a building fire evacuation.

Essential Personnel - Operations personnel assigned to the unit(s) that is impacted by the event, and emergency response personnel responding to the event.

Evacuation - The necessity to leave one area of the plant and report to another area of the plant due to the potential for unsafe conditions. Evacuation does not necessarily indicate a need to leave the refinery.

DOCUMENT NO:	HSE-EAP-003	PAGE:	3 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

Evacuation Point - Pre-designated locations to which personnel can report if they can not safely get to their primary Rally Point or to an alternate Rally Point. Evacuation Points are also utilized during an All Personnel Evacuations or when personnel must be moved from Rally Points due to the potential of changing conditions. Like Rally Points, Evacuation Points provide the means for personnel to report that they are safe and accounted for. The five Evacuation Points are listed in [Appendix 2](#), are marked via signage and are shown on the Refinery Evacuation Map [Appendix 1](#).

Facility Accountability Coordinator(s) – Assigned persons that gather accountability information during any “All Personnel” or “Plant-Wide” evacuation.

Non-Essential Personnel – All personnel who do not fit within the definition of Essential Personnel.

Rally Point – A pre-designated location to which personnel report during an event that calls for Non-Essential Personnel to Report to Rally points, or All Personnel Evacuations of a unit / area. Rally Points are either permanently located or temporarily designated (as an example, a turnaround may designate a temporary rally point for personnel working that turnaround). Rally Points are located in most major buildings. Accountability Readers are located near each Rally Point to provide the means for personnel to report that they are safe and accounted for.

ROLES & RESPONSIBILITIES

Accountability Coordinators

- Maintain an Accountability Board / Roster for your area of responsibility that provides In / Out / Location status for each person.
- Be able to quickly gather the In / Out / Location status of assigned personnel should you need to evacuate.
- Maintain a phone roster of area personnel for emergency contact.
- Understand the Accountability reporting structure for various evacuation levels and for your area of responsibility.
- Work with area supervision to assign and train an alternate Accountability Coordinator(s) during periods of absence / unavailability.
- Receive accountability reports from personnel who have had to evacuate a unit / area during Non-Essential Personnel Evacuations of a Unit / Area.
- Assist emergency management personnel in reconciling a persons' location if there is any question with regard to that person's accountability.
- Know area/building egress points and assist personnel during building fire evacuations.
- Gather and report accountability of assigned area personnel and visitors during building fire evacuations.
- Provide training for area personnel on accountability and evacuation procedures, emergency phone numbers, accountability locations, etc.

DOCUMENT NO:	HSE-EAP-003	PAGE:	4 OF 15
DOCUMENT NAME: EVACUATION AND PERSONNEL ACCOUNTABILITY			

All personnel within the refinery

- Required to be familiar with the evacuation and accountability requirements applicable to them and the areas in which they are working.
- Responsible for ensuring they are accounted for if they have been required to evacuate an area / building.

Building Point Coordinator

- Dons a blue "Building Point Coordinator" identification vest and reports with a plant radio to the Building Evacuation Point.
- Gathers personnel accountability information during a Building Fire Alarm Evacuation and reports that to the ERT Shift Commander or the Security Patrol Officer investigating the alarm.
- Assists personnel during building fire evacuations.
- Assists emergency management personnel in reconciling a person's location if there is any question with regard to that person's accountability.

Contractor Point of Contacts

- Serve as the Accountability Coordinator for non-resident contractors working under their supervision.
- Ensure non-resident contractors understand evacuation and accountability procedures applicable to them and their work location.

Employees or contractors hosting visitors

- Ensure their visitors or vendors are appropriately evacuated and accounted for.

Facility Accountability Coordinator(s)

- Report to EOC during any "Plant-Wide" or "All Personnel" evacuation.
- Gather personnel accountability information through the Lennel Access Control System during any "Plant-Wide" or "All Personnel" evacuation.

Security Officers (at Entry Points / Gates)

- Ensure each visitor / driver / vendor, etc is provided with a Visitors Safety Brochure.
- Instruct unescorted drivers to return to point of entry if alarm sounds while they are in transit.
- Ensure that the inbound side of all non manned gates and turnstiles is locked during any "Plant-Wide" or "All Personnel" evacuation to prevent unauthorized entry.

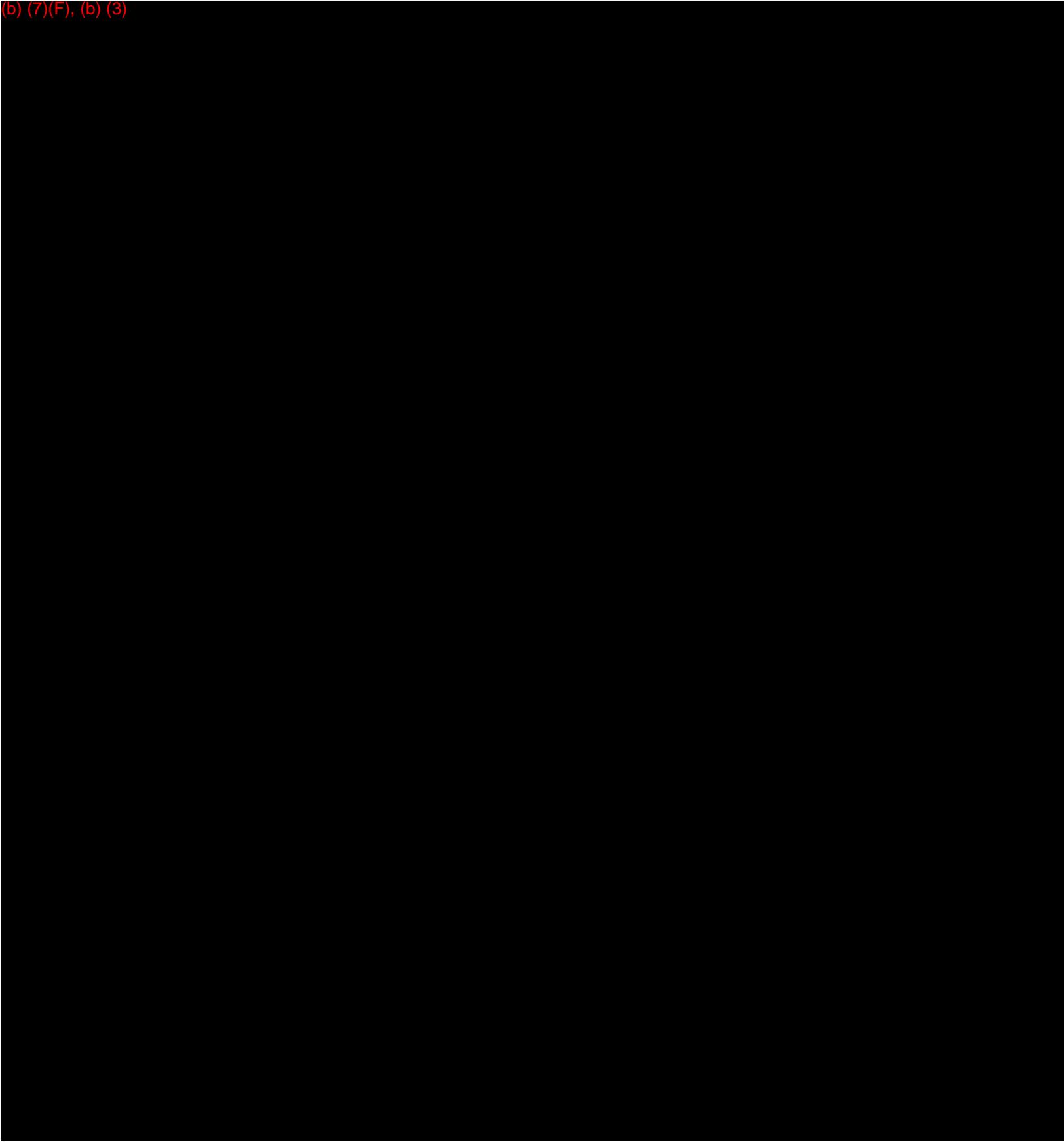
Supervision

- Ensure personnel within their area of responsibility have been trained on the evacuation and accountability procedures applicable to them and the areas that they may be working in.
- May serve as Accountability Coordinator for their area of responsibility.

DOCUMENT NO:	HSE-EAP-003	PAGE:	5 OF 15
DOCUMENT NAME: EVACUATION AND PERSONNEL ACCOUNTABILITY			

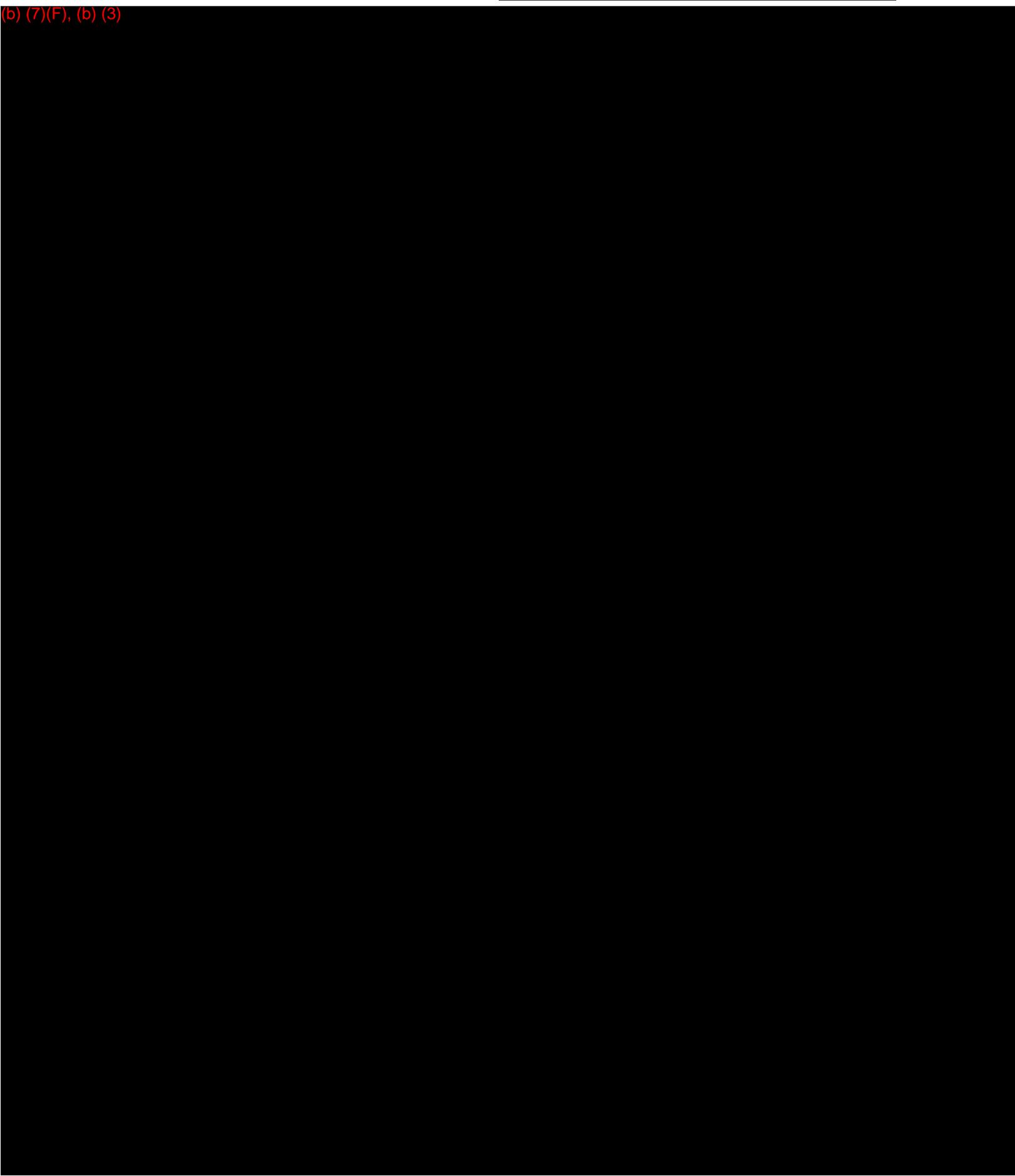
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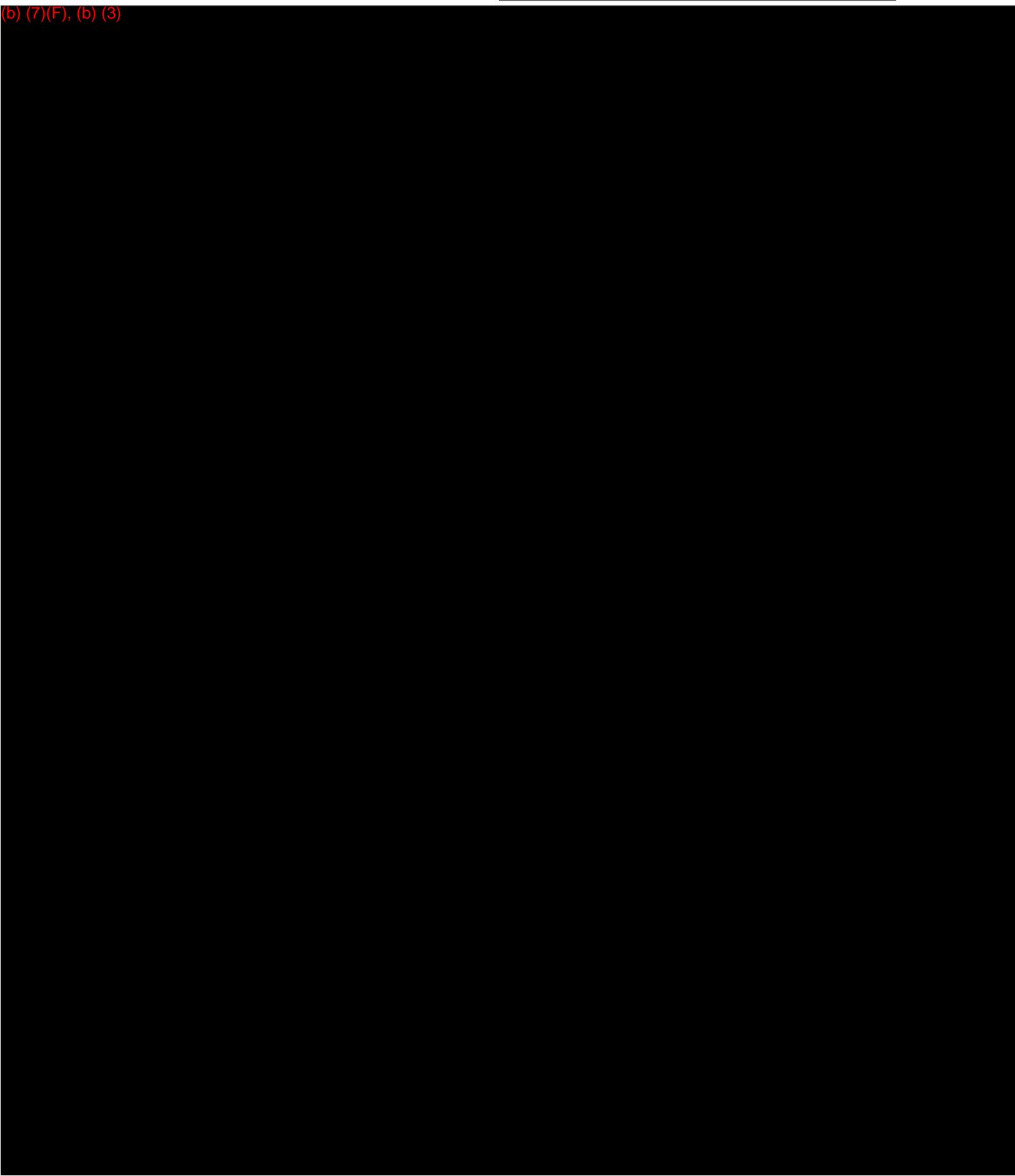
DOCUMENT NO:	HSE-EAP-003	PAGE:	6 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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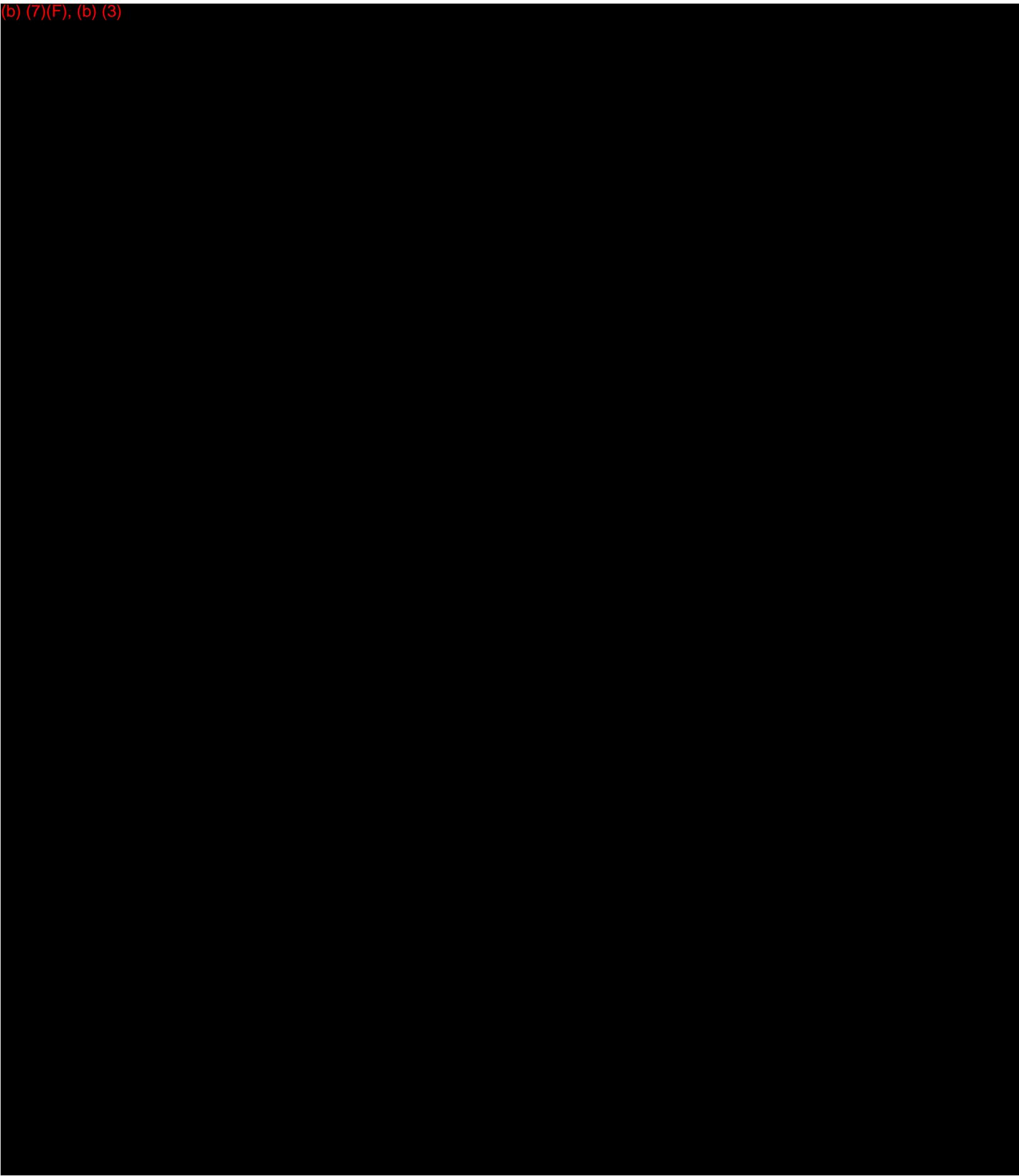
DOCUMENT NO:	HSE-EAP-003	PAGE:	7 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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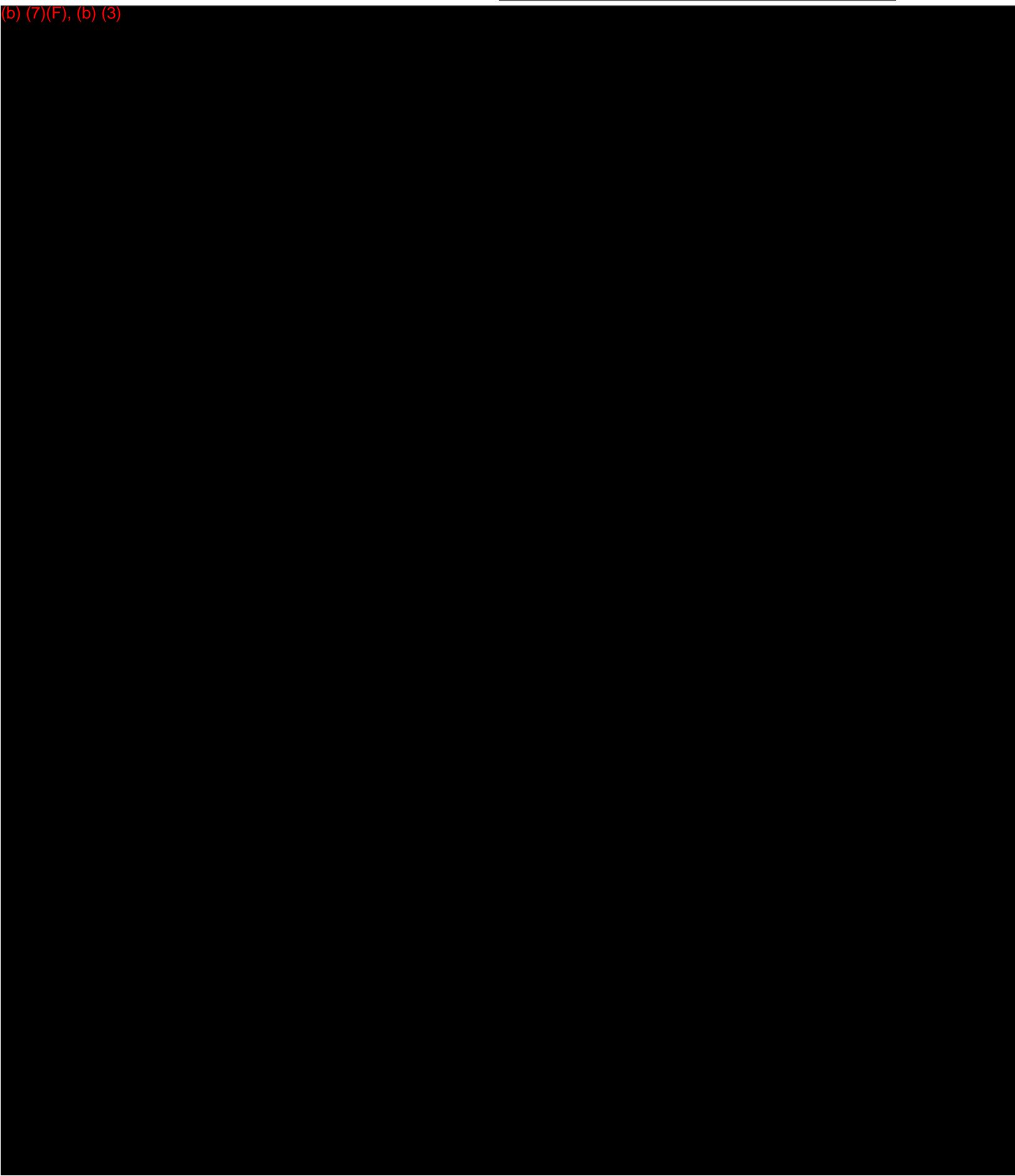
DOCUMENT NO:	HSE-EAP-003	PAGE:	8 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

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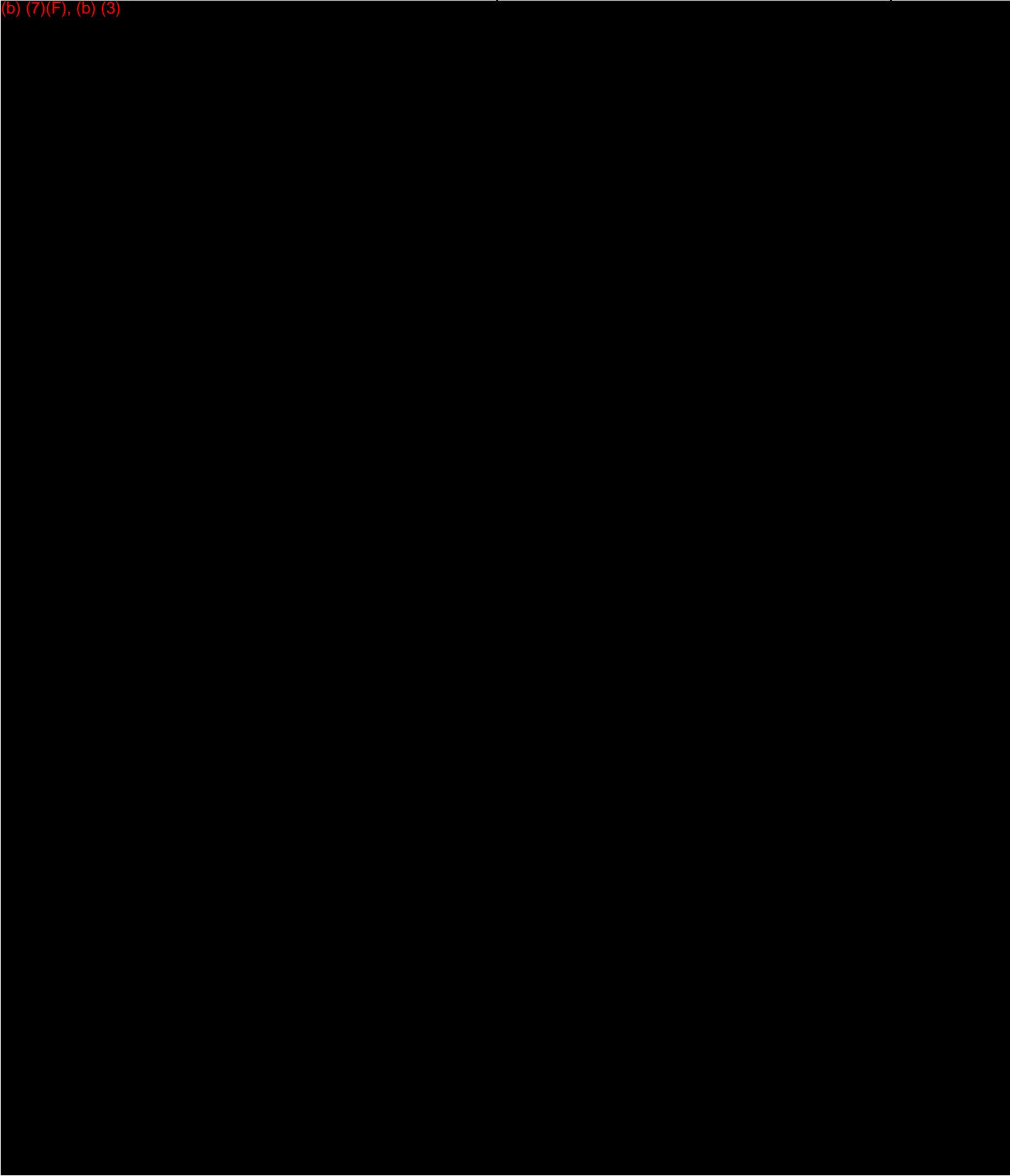
DOCUMENT NO:	HSE-EAP-003	PAGE:	9 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-003	PAGE:	10 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-003	PAGE:	11 OF 15
DOCUMENT NAME: EVACUATION AND PERSONNEL ACCOUNTABILITY			

TRAINING

Houston Refinery Employees shall be provided with training on this procedure at initial job assignment, with changes in job assignment / location and annually thereafter.

Visitors / Vendors / Delivery Drivers, etc. will be provided an overview of this procedure as part of their site orientation prior to entry.

DOCUMENT NO:	HSE-EAP-003	PAGE:	12 OF 15
DOCUMENT NAME: EVACUATION AND PERSONNEL ACCOUNTABILITY			

APPENDIX 1

Houston Refinery Evacuation Map

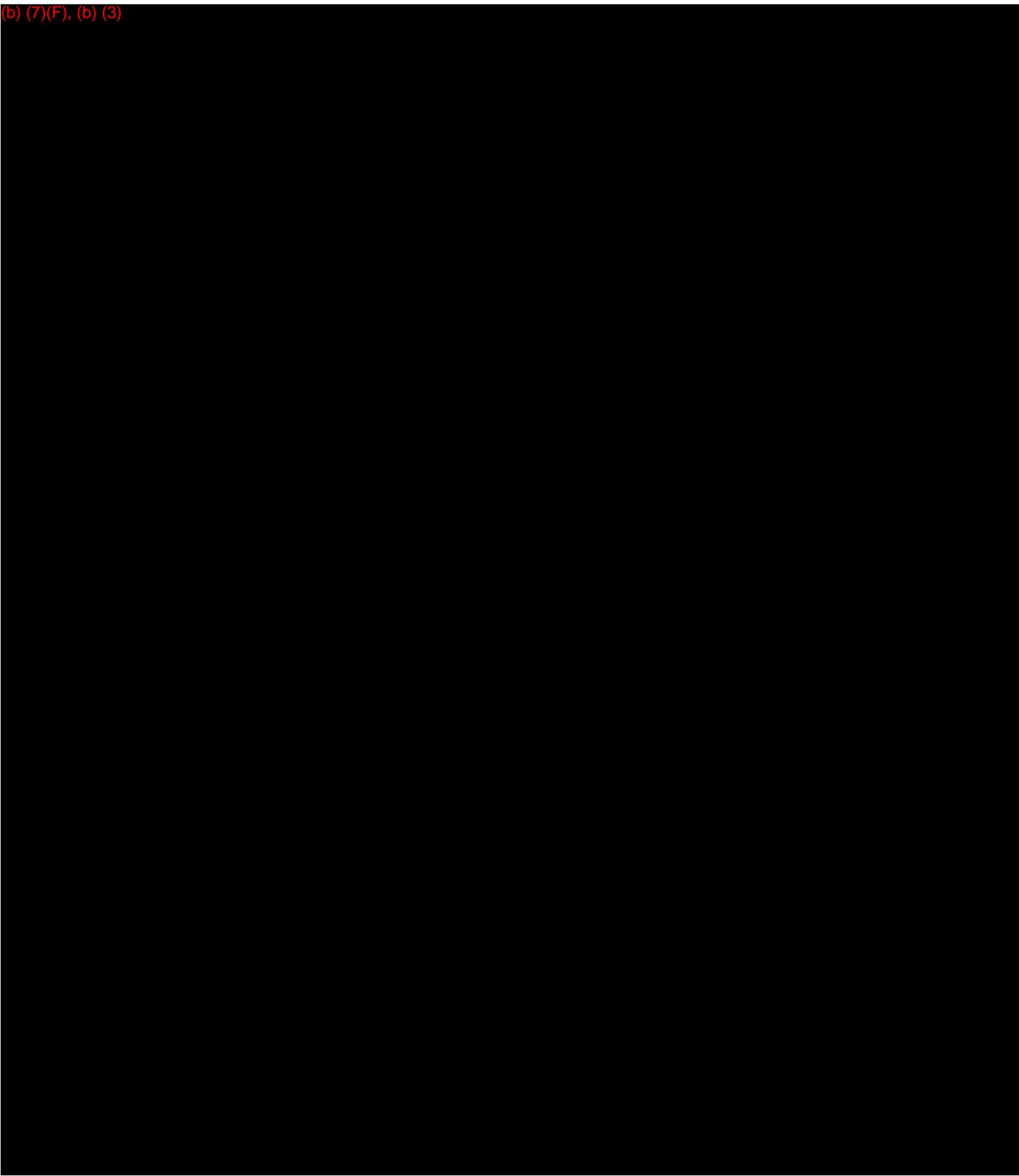


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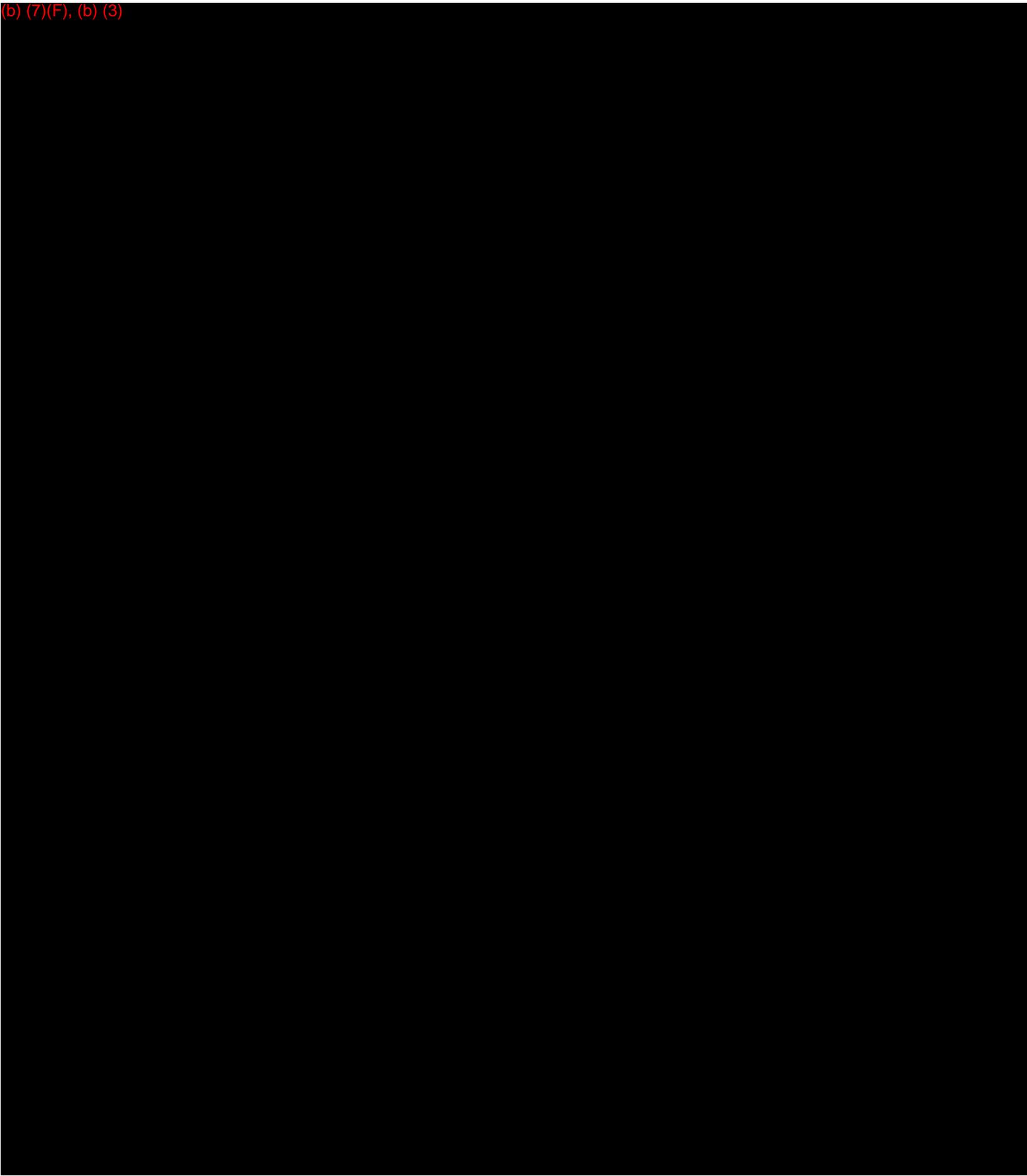
DOCUMENT NO:	HSE-EAP-003	PAGE:	13 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-003	PAGE:	14 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-003	PAGE:	15 OF 15
DOCUMENT NAME:			
EVACUATION AND PERSONNEL ACCOUNTABILITY			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
03/31/2010	J. Windham	Major Revision - Incorporated language applicable to electronic accountability process, removed Zones, removed Off-Site Evacuation Areas, revised on-site evacuation areas.	MLR 02/18/10
07/27/2010	J. Windham	Added language to require shift operations to account via Accountability Readers in addition to reporting manually. Added clarification for personnel not to re-enter evacuated areas until authorized to do so.	CFM 08/01/2010
11/01/2010	J. Windham	Revised procedure to reflect new ENS message syntax. Other miscellaneous clarifications	CFM 11/05/2010
2/28/2011	S. Kuhfeldt	Reformat, reorganize and regulatory review of procedure	

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-007	Page: 1 OF 30	Approval Date:	06/30/2011
Document Title:	INCIDENT COMMAND SYSTEM AND ORGANIZATION				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: JEFF WINDHAM	<i>Electronic Signature On File</i>		Review Date:	05/09/2011	

TABLE OF CONTENTS

Incident Command System	2
Incident Command / Incident Management Facilities	3
Incident Command Organization	4
Command Staff Positions	4
Operations / Tactical Supervision	5
Incident Command Organization Chart	8
Roles and Responsibilities	9
Incident Command	9
Safety Officer	12
Industrial Hygiene Officer	14
Environmental Officer	16
Security Coordinator	18
Operations Section Chief	20
Staging Area Manager	22
Branch Director(s)	24
Division Supervisor(s)	26
Group Supervisor(s)	28
Revision Summary	30

DOCUMENT NO:	HSE-EAP-007	PAGE:	2 OF 30
DOCUMENT NAME: INCIDENT COMMAND SYSTEM & ORGANIZATION			

INCIDENT COMMAND SYSTEM (ICS)

The Incident Command System (ICS) is the national standard process for managing responses to emergency incidents. The ICS consists of personnel, facilities, equipment, communications, and procedures, all operating within a common organizational structure to gain control of and mitigate an incident. The ICS can develop into a complex organization with the major functions being Command, Operations, Planning, Logistics, Liaison, and Safety.

The ICS is designed to allow for multi-agency adoption within industrial, federal, state, and local emergency agencies. Therefore, terminology used in the ICS is designed to be acceptable and understandable to across different emergency management organizations.

Houston Refining, LP has adopted the CIMA Incident Command System for use during all emergencies that occur at the facility.

Organization of the Incident Command System begins to develop from the time that initial resources arrive at an incident. The organization starts with management of major functions initially being the responsibility of one or just a few persons. As the incident develops in size and / or complexity, activities management is assigned to additional individuals in order to maintain a reasonable span of control. Necessary aspects of the organization are maintained through all active phases of the incident. Command is terminated at the point that active operations or incident hazards no longer present a need for operational control.

The basic organizational structure is also applicable to small incidents and incidents not directly involving releases, such as hurricanes, floods, rescues, or medical incidents. The system's organizational structure is able to adapt to any emergency incident or planned event that might occur on the facility.

DOCUMENT NO:	HSE-EAP-007	PAGE:	3 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

INCIDENT COMMAND / INCIDENT MANAGEMENT FACILITIES

Field Command Post: The Command Post is the location from which the Incident Commander, Field Coordinator and necessary support staff operate to direct and coordinate incident control activities. The Command Post will normally be in the Command Vehicle near the scene of the incident. In some cases however, the Command Post may be located away from the incident scene.

Emergency Operations Center (EOC)

The Emergency Operations Center is the location from which the Emergency Operations organization operates. The primary EOC is in the Administration Building – HSSE Wing. The EOC is provided with resources and equipment necessary for the EOC staff to perform their responsibilities including access to emergency plans, radios, telephones systems, a fax machine, checklists, plot plans, and networked computer systems.

Alternate EOC

The Alternate EOC is located at the Houston Refinery Training Center at 317 Allen Genoa Road in the Computer Training Room. Limited radio capability is available at the Alternate EOC via portable base radio stations and handheld radios. Additional handheld radios should be obtained prior to moving to the Alternate EOC. Electronic resource material such as emergency plans, plot plans, checklists, and telephone numbers / call lists are accessible from Alternate EOC networked computer systems. Hard copy material must be moved when the Alternate EOC is established.

Central Control Room Building (CCRB)

The CCRB is utilized by the Emergency Operations – Manufacturing Organization to provide tactical level operational support to the EOC.

Logistics Support Center

The Logistics Support Center is the locations to which logistics support personnel not directly assigned to EOC report to await orders from the Logistics Coordinator. The logistics Support Center is located in the Administration Building HSSE Wing – Old EOC Conference Room.

Media Information Center

The Media Information Center is the location from which the Public Information Officer or designee will provide information and briefings to members of the media. The Media Information Center will normally be established in Training Room D in the HRO Training Center when necessary. If that area is inadequate, the Employee Recreation Center or the Admin Building Main Office Conference Room can be utilized.

Agency Information Center

The Agency Information Center is the location from which information is shared with representatives of regulatory agencies. The Agency Information Center will normally be established in the Administration Building – West Wing Conference Room C. In the event Conference Room C is unavailable or inadequate, the Administration Building Main Office Conference Room should be utilized.

DOCUMENT NO:	HSE-EAP-007	PAGE:	4 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Staging Area

The Staging Area is a location near the incident, designated by Command to which unassigned emergency response resources will respond, check-in for accountability and wait for an assignment.

CIMA Staging Area

A CIMA Staging Area is established for temporary location of mutual aid resources. The staging areas are instituted by Command to control non-refinery resources that are not immediately assigned. Incoming mutual aid resources report to CIMA staging where they are checked in until requested by Command or the Operations Section Chief. The CIMA Staging Area Manager manages all aspects of the area. Primary CIMA Staging is located in the far east side of the Maintenance Parking Lot. Alternative CIMA Staging is located at the Credit Union Parking Lot or in the Lawndale Road corridor.

Medical Department: The HRO Medical Department may be utilized for various incident medical functions including but not limited to triage, treatment, or rehabilitation support.

Landing Zone (LZ): The Landing Zone(s) are the areas in which helicopters should be directed to land (i.e, Life Flight, Coast Guard). Landing Zones are located in the parking lot south of the Time Office – Adjacent to Gate 3, and in the northeast portion of the plant, NE of the SRU Complex. As an alternate, the Lawndale Road corridor, or any cleared parking lot can be used.

COMMAND STAFF

Incident Command

“Command” is the radio identifier used to distinguish the individual in charge of emergency response team efforts. The first arriving ERT officer establishes Command. If the Field Coordinator is on scene first, initial Command responsibilities become theirs. Command will then be transitioned to an appropriate ERT officer upon their arrival. See [Duties and Responsibilities: Incident Commander](#)

Safety Officer

A Safety Officer is established by Emergency Response – Command at every emergency involving a release of hazardous materials for the purpose of evaluating and monitoring safety hazards and related conditions. A Safety Officer may be established on non-release emergencies as well. Evaluation of all field operations and development of the Site Safety Plan is performed by or under the direction of the Safety Officer. Additional resources will be assigned as necessary to assist in safety observations during large incidents. When other safety assistants are established, they will be coordinated through the Safety Officer. See [Duties and Responsibilities: Safety Officer](#)

Industrial Hygiene Officer

The on-call Health & Safety Representative reports to the Command Post and becomes the Industrial Hygiene Officer during emergencies involving or having a potential to involve a release. With Command, the IH Officer will identify the materials involved, develop a

DOCUMENT NO:	HSE-EAP-007	PAGE:	5 OF 30
DOCUMENT NAME: INCIDENT COMMAND SYSTEM & ORGANIZATION			

monitoring strategy, and coordinate tactical implementation of the monitoring plan. The Industrial Hygiene Officer, will also support the Safety Officer in developing the Site Safety Plan. During minor events, the IH Officer personally implements monitoring actions or contacts additional Health and Safety resources as necessary. For large events, the IH Officer coordinates and supervises all industrial hygiene activities from the Command Van. See [Duties and Responsibilities: Industrial Hygiene Officer](#)

Environmental Officer

The on-call Environmental Representative reports to the Command Post and becomes the Environmental Officer during emergencies involving or having a potential to involve a release. With Command, the Environmental Officer will ensure proper notifications are made and that environmentally focused mitigation efforts are appropriate. The Environmental Officer is also responsible for coordinating agency interface during Alert 1 events. The Environmental Officer will attain additional resources and coordinate on-scene environmental support activities, as necessary. See [Duties and Responsibilities: Environmental Officer](#)

Security Coordinator

Security Patrol Unit 49 responds directly to the scene and checks in with Command. The Security Coordinator will immediately begin securing the area. The Security Coordinator will ensure communications with Command and will supervise all other personnel involved with scene security. See [Duties and Responsibilities: Security Coordinator](#)

Staging Area Manager

The Staging Area Manager position is established by Command to manage unassigned resources. During Mutual Aid events, a Channel Industries Mutual Aid (CIMA) Emergency Response Specialist may be asked to work with the Houston Refinery Staging Area Manager to manage outside resources. The Staging Area Manager establishes the Staging Area. The Staging Area Manager will track ERT resources as assigned or unassigned. The Staging Area Manager will dispatch resources to assignments as requested by Command or the Operations Section Chief. See [Duties and Responsibilities: Staging Area Manager](#)

Operations / Tactical Supervision

Operations Section Chief

As an incident organization grows or incident complexity becomes apparent, Command may establish an Operations Section Chief to direct deployment of resources, and oversee control and coordination of Branch Directors and Division / Group Supervisors. See [Duties and Responsibilities: Operations Section Chief](#)

Branch Director(s)

Branch Directors may be established as an intermediate supervisory layer of the incident command organization to maintain an effective span of control. When established, Branch directors will report to the Operations Section Chief and supervise Division / group Supervisors. See [Duties and Responsibilities: Branch Directors](#)

DOCUMENT NO:	HSE-EAP-007	PAGE:	6 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Tactical Divisions and Groups

Divisions and Groups are tactical level supervisors assembled to direct tactical action plans. Division / Group supervisors oversee task level resources assigned to them.

Division Supervisor(s)

Division Supervisors oversee operations within a defined geographical area and are responsible for supervision and accountability of assigned task level resources (i.e. North, South, or 1st. Floor Division). Division Supervisors will use their Division designation as a radio identifier (North Division). See [Duties and Responsibilities: Division Supervisor\(s\)](#)

Group Supervisor(s)

Group Supervisors oversee operations of a functional discipline (i.e., Hazmat, Rescue, or Medical Group) without regard for geographic division and are responsible for supervision and accountability of assigned task level resources. Group Supervisors will use their Group designation as a radio identifier (Hazmat Group). See [Duties and Responsibilities: Group Supervisor\(s\)](#)

Spill Group (Oil Spill Water)

The Spill Group Supervisor directs emergency response efforts relating to the control of spills on waterways. When established, the Spill Group will coordinate and direct the deployment of boats and boom to control a spill.

The Spill Group Supervisor will report to the affected dock or area and coordinate the operations from the shore position. From the dock, the Spill Group Supervisor will communicate tactical directions to spill team members deployed on shore and in boats.

The Spill Group may also be required to communicate or direct outside / contract spill personnel working in the affected area.

Hazmat Group

The Hazmat Group Supervisor directs emergency response efforts relating to the control of hazardous material releases. When established, the Hazmat Group Supervisor directly coordinates advanced tactical hazmat operations and supervises task level hazmat team leaders.

For further procedures see [Hazardous Materials Response Plan HSE-EAP-009](#)

Medical Group

When established, the Medical Group Supervisor directs response efforts in relating to Emergency Medical Services (EMS). The Medical Group may also be given the responsibility to set up a rehab area for evaluating Emergency Response Team (ERT) members.

The Medical Group will coordinate efforts with the Houston Fire Department (HFD) EMS Division and other medical service entities. The Operations Section Chief, Branch Director, or the Medical Group will normally have the HFD EMS Supervisor assigned with them to better manage the incident.

DOCUMENT NO:	HSE-EAP-007	PAGE:	7 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

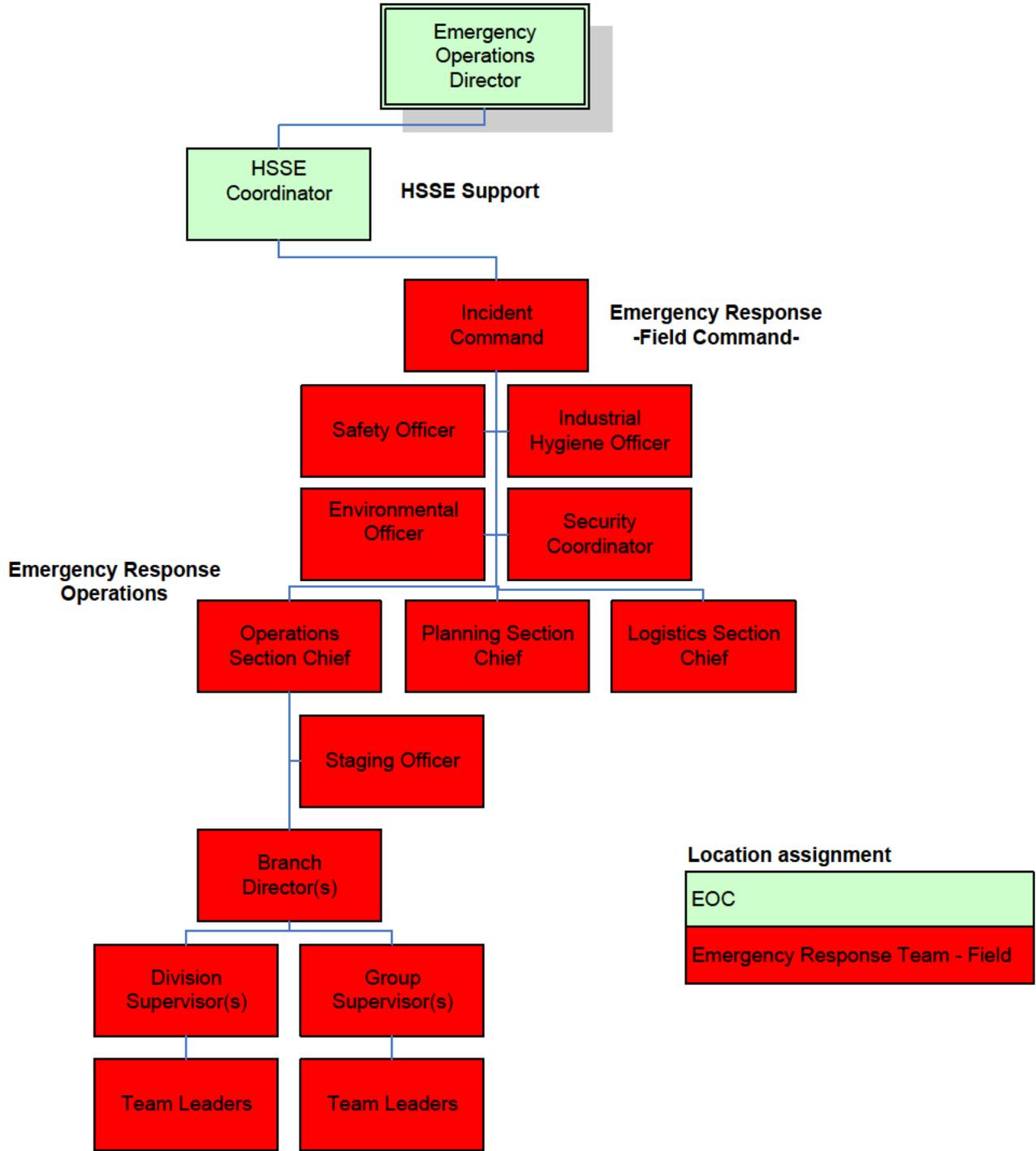
For further information see [Emergency Medical Services Plan HSE-EAP-010](#) and the [Rescue Response Plan HSE-EAP-011](#).

Rescue Group

When established, the Rescue Group Supervisor directs response efforts focused toward accomplishing safe and effective confined space and high angle rescue operations. The Rescue Group Supervisor position is established to supervise Rescue Team Leaders / rescue team personnel and coordinate activities with other functional areas in order to establish and maintain proper patient care.

DOCUMENT NO:	HSE-EAP-007	PAGE:	8 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

INCIDENT COMMAND SYSTEM ORGANIZATION



DOCUMENT NO:	HSE-EAP-007	PAGE:	9 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

ROLES & RESPONSIBILITIES

INCIDENT COMMAND



Assignment:	<ul style="list-style-type: none"> • Fire Chief
Alternate:	<ul style="list-style-type: none"> • Assistant Fire Chief • ERT Battalion Chief • ERT Senior Captain or Captain • Plant Shift Superintendent • Field Coordinator Qualified First Line Supervisor
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Reports to scene on all Alerts. Establishes Command. • Sets up Field Command Post as necessary.
Reporting:	<ul style="list-style-type: none"> • Reports to EOC HSE Coordinator.
Communications:	<ul style="list-style-type: none"> • Uses radio designation "Command". • Communicates on HSE-1 radio channel and by phone to HSE Coordinator in EOC. • Communicates with Plant Coordinator by phone. • Communicates with Field Coordinator directly. • Communicates with the Operations Section Chief on HSE-1 radio channel. • Communicates directly with Divisions or Groups if the Operations Section Chief is not established. • Communicates with staff officers on HSE-1 radio channel. • All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	10 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Incident Command
<ul style="list-style-type: none"> Exercises overall, on site direction and management of all Emergency Response Team efforts by defining strategic objectives, establishing priorities, and allocating resources.
<ul style="list-style-type: none"> Initiates and organizes the structure of the response receiving operational strategic direction from the Plan and Field Coordinators on response and process related concerns.
<ul style="list-style-type: none"> Initiates, maintains, and controls the communications process during the emergency.
<ul style="list-style-type: none"> Provides strategic plan to emergency response personnel. Command is Responsible for the provision and completion of tactical priorities. <p>Tactical priorities are:</p> <ul style="list-style-type: none"> Remove endangered occupants and treat injured. Stabilize the incident and provide for life safety. Conserve property. Provide for the safety, accountability and welfare of personnel (ongoing priority).
<ul style="list-style-type: none"> Develops and effective incident management organization.
<ul style="list-style-type: none"> Establishes formal Field Command Post (FCP) to coordinate field emergency operations.
<ul style="list-style-type: none"> Determines need for and issues orders for prompt evacuation of affected areas of the facility.
<ul style="list-style-type: none"> Plans for and ensures adequate staffing of emergency response team personnel in affected area.
<ul style="list-style-type: none"> Coordinates scene Industrial Hygiene, Security, Environmental, and Safety support efforts.
<ul style="list-style-type: none"> Works, in a unified manner, with the Field Coordinator to plan and implement response goals and objectives.
<ul style="list-style-type: none"> Supervises decisions on personal protective equipment requirements.
<ul style="list-style-type: none"> Reports information as necessary to the HSE Coordinator.
<ul style="list-style-type: none"> Ensures "Primary Search" is performed and personnel are accounted for in the affected area. Ensures "Secondary Search" is performed after the area is secured.

DOCUMENT NO:	HSE-EAP-007	PAGE:	11 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

<ul style="list-style-type: none">• Organizes and assigns emergency personnel consistent with the incident action plan.
<ul style="list-style-type: none">• Communicates incident response objectives and strategic goals to the Operations Section Chief.
<ul style="list-style-type: none">• Oversees overall safety of the ERT. Approves Site Safety Plan.
<ul style="list-style-type: none">• Requests and manages CIMA or other mutual aid resources.
<ul style="list-style-type: none">• Ensures site and scene control.
<ul style="list-style-type: none">• Assesses medical requirements and initiates medical response.

DOCUMENT NO:	HSE-EAP-007	PAGE:	12 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

SAFETY OFFICER



Assignment:	<ul style="list-style-type: none"> • Safety Officer qualified ERT Officer
Alternate:	<ul style="list-style-type: none"> • Safety Officer qualified ERT Member • Assigned Health & Safety Representative
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by Command at scene on all Alerts except for medical incidents as deemed not necessary
Reporting:	<ul style="list-style-type: none"> • Reports to Command
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel to Command. • Communicates with the Operations Section Chief, Branch Directors, Divisions, and Group Officers as necessary. • All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	13 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Safety Officer

- Monitors and evaluates safety hazards and related conditions during an emergency incident.
- Monitors emergency response efforts and advises Command on safety related problems and potential problems.
- Works with Industrial Hygiene Officer to complete and approve formal Site Safety Plan.
- Monitors and evaluates personal protective equipment used in regulated areas.
- Immediately stops any function, which involves imminent danger to personnel.
- When operating in a forward or otherwise hazardous location, must be attired in appropriate personnel Protective Equipment (PPE), including self-contained breathing apparatus (SCBA); have radio communication; and be accompanied by another ERT member.
- Ensures that regulated areas are defined, properly marked and complied with.
- The Safety Officer recommends any changes to the action plan as a result of on-going surveys.
- Monitors and evaluates decontamination processes and procedures.
- Conducts surveys to identify existing or potential hazards and informs Command of their findings.
- Recommends and requests the appointment by Command of Assistant Safety Officers as required by scene conditions.

DOCUMENT NO:	HSE-EAP-007	PAGE:	14 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

INDUSTRIAL HYGIENE OFFICER (IH OFFICER)



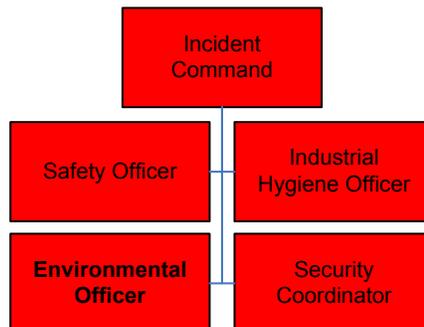
Assignment:	<ul style="list-style-type: none"> On-Call Health & Safety Representative
Alternate:	<ul style="list-style-type: none"> Assigned ERT member
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Responds to the Command Post on all alerts except for medical and rescue incidents.
Reporting:	<ul style="list-style-type: none"> Reports to Command
Communications:	<ul style="list-style-type: none"> Communicates on HSE-1 radio channel to Command. Communicates with other responding industrial hygienists, HSE Safety Representatives, the Operations Section Chief, Branch Directors, Division and Group Supervisors as necessary. All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	15 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Industrial Hygiene Officer
<ul style="list-style-type: none"> • Supports and coordinates overall health related matters.
<ul style="list-style-type: none"> • Coordinates on-scene industrial hygiene monitoring.
<ul style="list-style-type: none"> • Manages industrial hygiene resources.
<ul style="list-style-type: none"> • Works with Safety Officer in developing the Site Safety Plan.
<ul style="list-style-type: none"> • Documents health reporting and other matters.
<ul style="list-style-type: none"> • May be requested to provide resources for offsite monitoring.
<ul style="list-style-type: none"> • Provides technical support on product and refinery streams.
<ul style="list-style-type: none"> • Assists in product identification and coordinates outside technical assistance.
<ul style="list-style-type: none"> • When operating in a forward or otherwise hazardous location, must be attired in appropriate personnel Protective Equipment (PPE), including self-contained breathing apparatus (SCBA); have radio communication; and be accompanied by another ERT member.
<ul style="list-style-type: none"> • Provides site assessment and consultation on health exposures.
<ul style="list-style-type: none"> • Reports health assessments and monitoring data to the Incident Commander and the Operations Section Chief.
<ul style="list-style-type: none"> • Works with Safety Officer to establish regulated areas.
<ul style="list-style-type: none"> • Consults with Medical Officer on health and hygiene matters.
<ul style="list-style-type: none"> • Works with Hazmat Division to establish PPE requirements and assists with decon strategy.
<ul style="list-style-type: none"> • Obtains technical information on stock items purchased from manufacturers as necessary.
<ul style="list-style-type: none"> • Obtains MSDS information.
<ul style="list-style-type: none"> • Recommends any changes to the action plan as a result of on-going surveys.

DOCUMENT NO:	HSE-EAP-007	PAGE:	16 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

ENVIRONMENTAL OFFICER



Assignment:	<ul style="list-style-type: none"> On-Call Environmental Representative
Alternate:	<ul style="list-style-type: none"> Other assigned Environmental Representative
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Responds to the Field Command Post during all alerts except for Medical and Rescue Incidents.
Reporting:	<ul style="list-style-type: none"> Reports to Command.
Communications:	<ul style="list-style-type: none"> Communicates on HSE-1 radio channel and by phone to Environmental Support Unit in EOC. Communicates with other Environmental Engineers and HSE personnel as necessary. All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

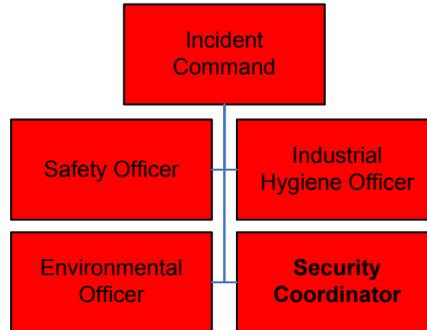
DOCUMENT NO:	HSE-EAP-007	PAGE:	17 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Environmental Officer

- Supports and coordinates on-scene and on-site environmentally related matters.
- Monitors on-scene conditions related to the emergency, which have environmental implications.
- Provides environmental assessment and consultation to affected area on exposure and controls.
- Ensures that environmental reporting is performed. Updates reporting as necessary.
- Assists in documenting environmental reporting and other matters.
- Works with Environmental Support Unit in EOC to ensure escorts are provided for responding environmental agencies.
- Manages on-scene environmental resources.
- Works with Environmental Support Unit in EOC on resource management for all environmental matters.
- Advises Command and the Field Coordinator on environmental matters.
- Coordinates attainment of any spill or release safety permits. Makes arrangements for sample analysis.

DOCUMENT NO:	HSE-EAP-007	PAGE:	18 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

SECURITY COORDINATOR



Assignment:	<ul style="list-style-type: none"> • Security Team Leader
Alternate:	<ul style="list-style-type: none"> • Assigned HSE Security Representative
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Responds directly to scene on any Alert. Immediately secures the affected area.
Reporting:	<ul style="list-style-type: none"> • Reports to Command.
Communications:	<ul style="list-style-type: none"> • Communicates with Command on HSE-1 radio channel. • Communicates with other responding Security Representatives. • All communications will begin on HSE-1 radio channel until orders are given by Command to divide traffic.

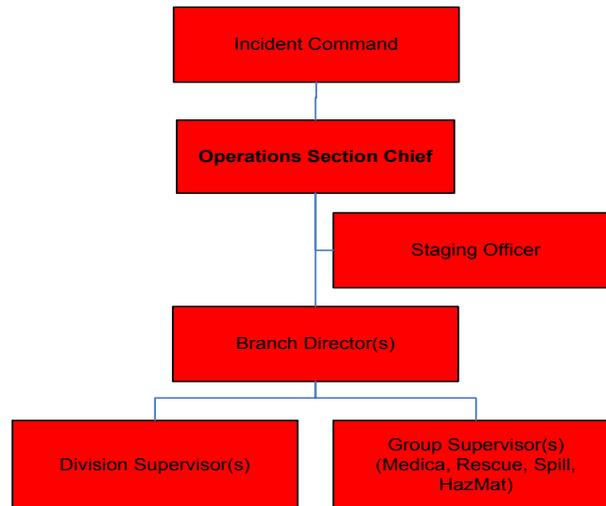
DOCUMENT NO:	HSE-EAP-007	PAGE:	19 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Security Coordinator

- Coordinates on-scene and site security related matters.
- Coordinates on-scene security and roadblock assistance. Controls access routes to incident area and routes traffic.
- Assists Command and the Security Support Unit in assessing on-site scene security needs.
- Assists in documenting security reporting and other matters.
- Works with the Staging Area Manager to establish escorts and directions for outside resources.
- Coordinates runners as necessary for Command.
- Ensures alternate EOC (HRO Training Center) is accessible if needed.
- Manages security resources on site.
- Ensures that on-scene security reporting is performed.
- Secures scene and evidence as requested.
- Assists Air Operations Officer in securing landing zone.
- Coordinates with Medical Officer to establish triage area.

DOCUMENT NO:	HSE-EAP-007	PAGE:	20 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

OPERATIONS SECTION CHIEF



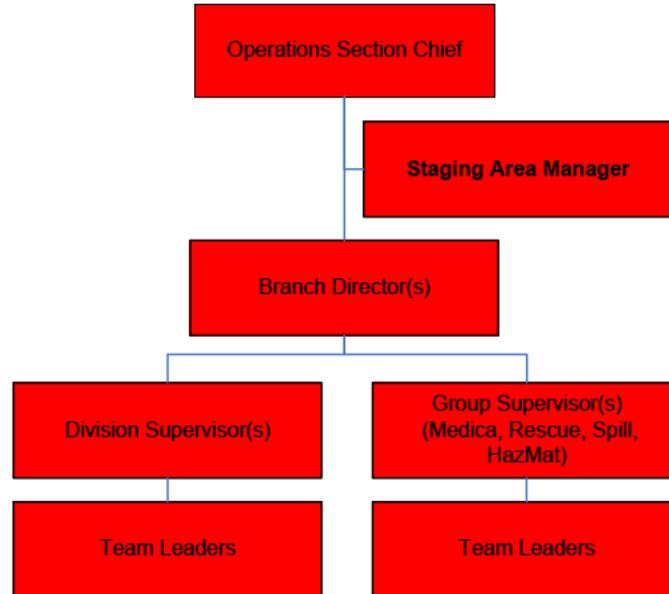
Assignment:	<ul style="list-style-type: none"> • Assistant Fire Chief
Alternate:	<ul style="list-style-type: none"> • Battalion Chief • Assigned Senior Captain or Captain • Assigned Lieutenant
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by Command as required.
Reporting:	<ul style="list-style-type: none"> • Reports to Command.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with Command. • Communicate directly with: <ul style="list-style-type: none"> ○ Divisions or Groups on HSE-1 radio channel. ○ Staging Area Manager on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	21 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Operations Section Chief
<ul style="list-style-type: none"> • When established, the Operations Section Chief is responsible for direct management of all incident Emergency Response Team (ERT) tactical activities.
<ul style="list-style-type: none"> • Obtains strategic goals and directions from Command.
<ul style="list-style-type: none"> • Translates strategic goals to tactical action plans.
<ul style="list-style-type: none"> • Oversees the control, coordination, and supervision of all branch, division, and group activities.
<ul style="list-style-type: none"> • Directs Branch Directors, Divisions and Groups in establishing fire lines and controlling hot zones.
<ul style="list-style-type: none"> • May establish Branch Directors, Divisions, and Groups as necessary.
<ul style="list-style-type: none"> • Initiates search and rescue activities to ensure accountability of personnel.
<ul style="list-style-type: none"> • Resolves high-level ERT logistics issues.
<ul style="list-style-type: none"> • Determines needs and requests additional resources.
<ul style="list-style-type: none"> • Provides reports to superior as required.
<ul style="list-style-type: none"> • Reports information on special activities, events, and occurrences as necessary to Command.
<ul style="list-style-type: none"> • Supervises deployment of resources, continually evaluates the response effort, and maintains communications with the field command post.
<ul style="list-style-type: none"> • Interacts with process operations personnel as required.
<ul style="list-style-type: none"> • Assigns task assignments in association with action plans.
<ul style="list-style-type: none"> • Communicates incident response strategic goals and tactical objectives to Branch Directors, Divisions, and Groups.

DOCUMENT NO:	HSE-EAP-007	PAGE:	22 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

STAGING AREA MANAGER



Assignment:	<ul style="list-style-type: none"> Assigned Senior Captain or Captain
Alternate:	<ul style="list-style-type: none"> Assigned ERT Member Assigned HSE Security Representative May be assigned to CIMA Emergency Response Specialist.
Notification:	<ul style="list-style-type: none"> Emergency Notification System
Response:	<ul style="list-style-type: none"> Established for all Alerts. Responds to designated Staging area as required.
Reporting:	<ul style="list-style-type: none"> Reports to Command or if established, to the Operations Section Chief
Communications:	<ul style="list-style-type: none"> Communicates on HSE-1 radio channel to the Operations Section Chief. All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

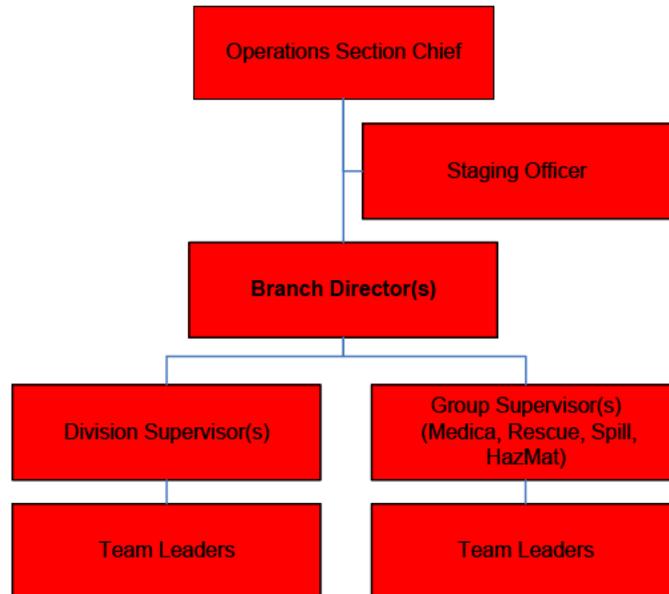
DOCUMENT NO:	HSE-EAP-007	PAGE:	23 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Staging Area Manager

- The Staging Area Manager coordinates all staging activities.
- Establishes all functions of staging outside resources.
- Keeps Command or the Operations Section Chief respectively informed of resource status.
- Documents all staged resources according to CIMA procedures. Maintains log of companies in staging area and keeps appropriate inventory of information.
- May be assigned to request resources.
- Assigns additional staging personnel as required to manage scene. Coordinates staging personnel activities
- Maintains records of ERT personnel responding.
- Coordinates operations of Cascade Unit
- Manages routing of resources to appropriate Divisions or Groups. Works with Security Coordinator to provide appropriate direction or escorts into facility.
- Ensures all apparatus are parked and organized in an appropriate manner.
- Assists Command in determining what level of staging to maintain (usually 50% of committed resources).
- Assist with management of Rehab supplies.

DOCUMENT NO:	HSE-EAP-007	PAGE:	24 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

BRANCH DIRECTOR



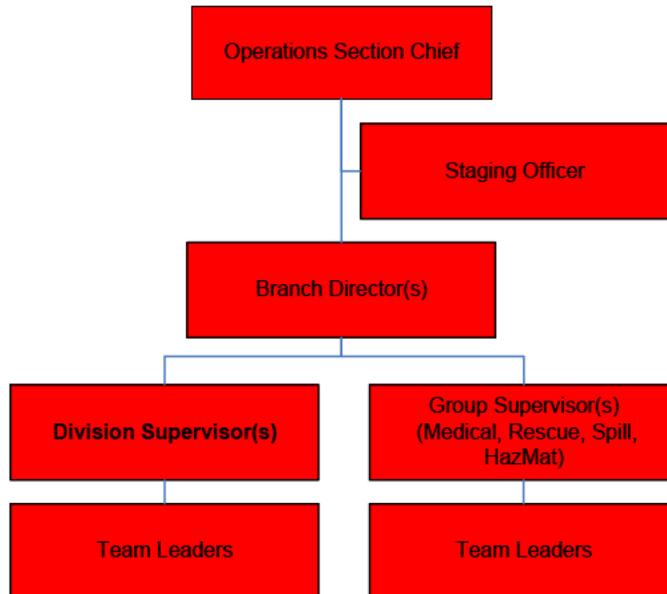
Assignment:	<ul style="list-style-type: none"> • Battalion Chief
Alternate:	<ul style="list-style-type: none"> • Assigned Senior Captain or Captain • Assigned Lieutenant
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by Command or the Operations Section Chief as required.
Reporting:	<ul style="list-style-type: none"> • Reports to the Operations Section Chief.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with the Operations Section Chief. • Communications with Divisions and Groups on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	25 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Branch Director(s)
<ul style="list-style-type: none"> When established, Branch Directors are responsible for management of Emergency Response Team (ERT) tactical activities in their designated area of responsibility. A Branch Directors area of responsibility may be defined geographically or functionally.
<ul style="list-style-type: none"> Obtains strategic goals and directions from the Operations Section Chief.
<ul style="list-style-type: none"> In their assigned area of responsibility, initiates search and rescue activities to ensure accountability of personnel.
<ul style="list-style-type: none"> Assigns tactical work tasks to Divisions and Groups.
<ul style="list-style-type: none"> May establish Divisions and Groups as necessary.
<ul style="list-style-type: none"> Oversees the control, coordination, and supervision of all Divisions and Groups under their direction.
<ul style="list-style-type: none"> Directs Divisions in establishing fire lines and controlling hot zones.
<ul style="list-style-type: none"> Supervises deployment of resources to Divisions or Groups, continually evaluating the status of tactical actions.
<ul style="list-style-type: none"> Reports information on special activities, events, and occurrences as necessary to the Operations Section Chief.
<ul style="list-style-type: none"> Interacts with process operations personnel as required.
<ul style="list-style-type: none"> Assigns task duties in association with action plans.
<ul style="list-style-type: none"> Communicates incident response tactical objectives to Divisions or Groups.
<ul style="list-style-type: none"> Resolves logistic problems.

DOCUMENT NO:	HSE-EAP-007	PAGE:	26 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

**DIVISION SUPERVISOR(S)
(Geographic)**



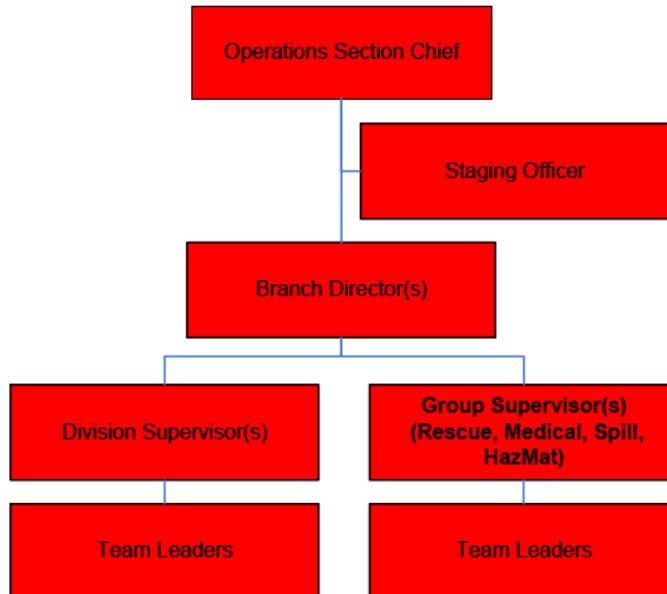
Assignment:	<ul style="list-style-type: none"> • Senior Captain
Alternate:	<ul style="list-style-type: none"> • Assigned Captain • Assigned Lieutenant • Assigned ERT member
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by the Operations Section Chief or Branch Director as required.
Reporting:	<ul style="list-style-type: none"> • If Branches are not established, reports to the Operations Section Chief • Reports to Branch Director when established.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with the Operations Section Chief, or if established Branch Director. • Communicates with other Divisions or Groups on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	27 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Division Supervisor(s)
<ul style="list-style-type: none"> • When established, Division Supervisors directs the response effort of Emergency Response Team (ERT) members in tactical divisions as assigned.
<ul style="list-style-type: none"> • Provides tactical action as directed in geographic area.
<ul style="list-style-type: none"> • Assigns task duties to ERT members.
<ul style="list-style-type: none"> • Directly supervises ERT members assigned to their respective division.
<ul style="list-style-type: none"> • Provides the tactical action plan to ERT Leaders and members.
<ul style="list-style-type: none"> • Determines and requests assistance and resources in order to perform assigned actions.
<ul style="list-style-type: none"> • Reports as necessary to superior.
<ul style="list-style-type: none"> • Interacts with process operations personnel as required.
<ul style="list-style-type: none"> • Coordinates activities with adjacent Divisions and Groups.
<ul style="list-style-type: none"> • Reports special occurrences or events, such as accidents or sickness, to superior.
<ul style="list-style-type: none"> • Participates in the development of branch tactical plans.

DOCUMENT NO:	HSE-EAP-007	PAGE:	28 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

GROUP SUPERVISOR(S)
(Medical, Rescue, Spill, Hazmat)



Assignment:	<ul style="list-style-type: none"> • Senior Captain
Alternate:	<ul style="list-style-type: none"> • Assigned Captain • Assigned Lieutenant • Assigned ERT member
Notification:	<ul style="list-style-type: none"> • Emergency Notification System
Response:	<ul style="list-style-type: none"> • Established by the Operations Section Chief or Branch Director as required.
Reporting:	<ul style="list-style-type: none"> • If Branches are not established, reports to the Operations Section Chief • Reports to Branch Director when established.
Communications:	<ul style="list-style-type: none"> • Communicates on HSE-1 radio channel with the Operations Section Chief, or if established Branch Director. • Communicates with other Divisions or Groups on HSE-1 radio channel. • Communicates with Boat Crew on HSE-1 radio channel. • Communicates with process operators as required. • All tactical operations will begin communications on HSE-1 radio channel until orders are given by Command to divide traffic.

DOCUMENT NO:	HSE-EAP-007	PAGE:	29 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

Duties and Responsibilities: Group Supervisor (Medical, Rescue, Spill, Hazmat)
<ul style="list-style-type: none"> • When established, Group Supervisor directs ERT tactical efforts and actions relating to their functional assignment.
<ul style="list-style-type: none"> • Provides tactical action as directed in functional area.
<ul style="list-style-type: none"> • Provides the tactical action plan to ERT Leaders and members.
<ul style="list-style-type: none"> • Determines and requests resources in order to perform assigned actions.
<ul style="list-style-type: none"> • Provides action plan and reviews safety procedures with personnel.
<ul style="list-style-type: none"> • Supervises ERT members assigned to their respective group.
<ul style="list-style-type: none"> • Interacts with process operations personnel as required.
<ul style="list-style-type: none"> • Reports as necessary to Command / the Operations Section Chief / a Branch Director.
<ul style="list-style-type: none"> • Coordinates activities with adjacent Divisions and Groups.
<ul style="list-style-type: none"> • Reports special occurrences or events, such as accidents or sickness, to superior.
<ul style="list-style-type: none"> • Participates in the development of functional tactical plans.

DOCUMENT NO:	HSE-EAP-007	PAGE:	30 OF 30
DOCUMENT NAME:			
INCIDENT COMMAND SYSTEM & ORGANIZATION			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required.
All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
05/09/2011	Jeff Windham	Reformat, reorganize and regulatory review of procedure	

Houston Refining LP	DOCUMENT NUMBER:	HSE-EAP-008	Page: 1 of 13	Approval Date:	06/30/2011
Document Title:	COMMUNICATIONS				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	05/10/2011	

Communications are a critical element of the emergency response and management effort. During emergencies communications must be immediate and accurate.

This Communications Plan provides information on the communications systems available to communicate to internal and external stakeholders during various emergency events.

EMERGENCY COMMUNICATIONS AND NOTIFICATION

Main Gate Dispatch is equipped with two-way radios, telephones, paging systems and a refinery Emergency Notifications System (ENS). The Dispatch Center is staffed 24 hours a day by a security representative trained for routine and emergency situations. Dispatchers also maintain a current telephone call-out list and the telephone numbers for all support agencies whose assistance might be needed during any type of emergency or incident. The ENS provides emergency and evacuation instructions to personnel throughout the facility. Consequently, the Main Gate is the focal point for emergency communications both inside and outside the refinery.

A secondary point for emergency communications is the Central Control Room (CCRB). The primary focus of the CCRB is communications with the process operating units during routine and emergency operations. The CCRB is equipped with radios, telephones, and a redundant Emergency Notification System (ENS) control console. These systems make the control room a fully functional secondary dispatch center.

Refinery Radio System

The refinery operates a trunked type radio system, which provides radio communication between personnel, vehicles, and key locations. A hub console, located at the Main Gate, can control all radio traffic for the entire system.

See [Appendix 5](#) for a list of radio system talkgroups

Radio Announcement System

The Radio Announcement System broadcasts a simultaneous message to every talkgroup channel on the radio system. The Announce System can be utilized for emergency and general plant announcements.

The Radio Announce System can be activated from the Main Gate Dispatch Console, and several specially programmed radios in the facility. Additionally, for emergencies, the Radio Announce System is integrated with the refinery Emergency Notification System (ENS).

NOTE: The Radio Announce System (activated from the Dispatch Radio Console) is the backup in the case of complete ENS failure.

DOCUMENT NO:	HSE-EAP-008	PAGE:	2 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

Radio Repeater Backup Systems

In the event of repeater failure the trunked radio system has two (2) backup modes available:

❑ Failsaft

During a partial system failure, radio talkgroups will be automatically pooled, or routed, onto three (3) repeaters by the system controller. This allows for limited radio communication. All users should limit communication to short messages that are absolutely necessary.

Users can recognize a failsaft condition by an audible soft tone heard on all radios every ten (10) seconds. Radios will indicate the condition by displaying the text "FAILSOFT" on the LCD screen every ten (10) seconds.

❑ Total Failure

A total radio system failure will be indicated by an audible soft tone heard on all radios every ten (10) seconds accompanied by the text "OUT OF RANGE" on the LCD screen every ten (10) seconds.

In the case of total system failure (repeater failure), Talkaround or Simplex Channels have been established for emergency communications. Talkaround channels do not utilize the trunked repeater system, thus allowing a fail-safe design that enables users to communicate "radio to radio" with limited range.

Talkaround channels are available and during a total system failure shall be allocated as indicated below:

Ops T/A 1	FCCU, Oil Movements
Ops T/A 2	Crudes, HDS, Light HDS
Ops T/A 3	Cokers
Ops T/A 4	SRU. Lubes
Maint T/A 1	South Maintenance
Maint T/A 2	North maintenance
ERT Tac 1	Primary HSSE and Emergency
ERT Tac 2	Secondary HSSE and Emergency
ERT Tac 3	Secondary HSSE and Emergency
ERT Tac 4	Secondary HSSE and Emergency
ERT Tac 5	Secondary HSSE and Emergency

DOCUMENT NO:	HSE-EAP-008	PAGE:	3 OF 15
DOCUMENT NAME: COMMUNICATIONS			

Backup Radio System

In addition to the talkaround channel plan, a backup radio system is available and may be placed in service. The backup radio system is a self-contained mobile radio system, which provides five (5) fully functional repeaters; four (4) of which are available for voice communication. With the backup system in service, normal radio system talkgroups can be used. This system cannot be used in conjunction with Talkaround channels. In the event this system is forced into service, users will be directed to return to their normally assigned talkgroups. Keeping communication to a minimum is imperative while using the backup system due to its limited number of repeaters and concurrent use by process units.

(b) (7)(F), (b) (3)

Emergency Notification System ENS

The refinery Emergency Notification System (ENS) is used to advise personnel of emergency response and evacuation orders (See the [HSE-EAP-002 Emergency Notification and Response](#), and [HSE-EAP-003 Evacuation and Personnel Accounting Procedure](#)).

The ENS is an integrated multi-media system designed for the purpose of communicating emergency messages to plant occupants. The system consists of tone, voice, and text messaging to a combination of sub-systems throughout the facility.

The ENS may also be used to inform personnel of situations such as non-emergency incidents, severe weather conditions, or abnormal operational issues.

NOTE: the Main Gate Dispatcher conducts a full ENS test every Thursday at noon.

DOCUMENT NO:	HSE-EAP-008	PAGE:	4 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

ENS Components

ENS components can be described as follows:

ENS Media System Components	Type of Message and Location
Plant Radio Announce Talkgroup	Signal tone and voice message on all refinery radio system Talkgroups (Channels).
Building Public Address (PA) Systems	Signal tone and voice message on public address systems in buildings (Indoor public address sites).
Siren/Speaker Sites and Distributed Audio Systems	Signal tone, voice message, and signal strobe light from Plant/Siren Sites and Distributed Audio Speakers in operating area and units (Outdoor sites).
Message Signs	Text message signs located at refinery main entry points and gates.
Emergency Management Pager System	Text message sent to emergency management group pagers. Appendix 4 : lists the various emergency management pager groups.
Workstation PC Messaging	Pop-up text message sent to all LAN PC workstations.

The ENS components can be initiated by a single activation for Emergency Alerts, or may be set off individually for specific or special emergency notification or message requirements.

See [Appendix 1](#) for an illustration of the ENS architecture.

See [Appendix 2](#) for a description of the ENS component activation logic.

ENS Activation

Upon notification of an emergency, the Main Gate Dispatcher activates the ENS from the primary console. Emergency activation of the ENS will communicate emergency information by tone, voice and text message. Information provided will include Alert Level, Type of Emergency, Location, Wind Direction and Evacuation Type. Additionally, the system is used to advise of any further special information.

An All Clear is issued over the ENS to indicate that the emergency has been terminated.

DOCUMENT NO:	HSE-EAP-008	PAGE:	5 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

Backup ENS Capability

In the event of primary ENS console failure, three (3) fully capable backup consoles may activate the ENS from the following locations.

- ❑ Central Control Room (CCRB)

The CCRB console may also be used by Operations as a secondary means of communications to Operating Units or Areas.

- ❑ Command Van
- ❑ Maintenance Radio Shop at Site D

NOTE: The Radio Announce System (activated from the Dispatch Radio Console) is the backup in the case of complete ENS failure.

ENS Signal Tones

There are three signal tones generated by the ENS:

High Low Signal	Alert for fire, spill, gas release or other emergency / event requiring action by plant personnel
Steady Tone Signal	All Clear
Pulse Signal	All personnel plant-wide report to Evacuation Points

Unit Distributive Audio

Distributive Audio Systems provide unit specific communications with the placement of speakers throughout an area. The ENS System is directly linked to unit distributive audio where available. Distributive systems may also be directly linked to hazard detection systems in order to expediently warn personnel and evacuate a process unit. Process areas with Distributive Audio Systems are listed as follows:

- ❑ SRU 434
 - Includes units 433/434/435/437
 - System directly linked to H₂S detection systems.
- ❑ SRU 439
 - Includes units 439/440/441/442
 - System directly linked to H₂S detection systems.
- ❑ 636 Hydrotreater
- ❑ 736 Coker
- ❑ 737 Coker
- ❑ 537 Crude Still

DOCUMENT NO:	HSE-EAP-008	PAGE:	6 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

Emergency Management Pager System

Primary emergency notification to off-site emergency management / response personnel is conducted through the emergency management pager system. The pager system is a module of the Emergency Notification System. ENS Alert activation results in automatic activation of the pre-determined pager group(s). Manual activation of pager groups and individual pagers is accomplished by the Main Gate Dispatcher.

Emergency management pagers are established into three different cap code pager groups:

Alert 1 Pager Group Cap Code: 0399998	ERT Officers HSSE Personnel Security Personnel Refinery Leadership Team
Alert 2 + Pager Group: Cap Code: 0300103	ERT Members (non-officers) Other identified emergency management support personnel
ERT Pager Group Cap Code: 0399999	All ERT Members

See [Appendix 3](#) for a description of the pager group activation logic and examples of additional programmed pager groups.

Emergency Pager Backup Systems

Two (2) pager backup systems are available:

- Quickpage System

The Quickpage system is a portable system capable of initiating alphanumeric pages to Emergency Management groups.

- AutoDial System

An AutoDial telephone system is programmed to send numeric coded messages to Emergency Management groups. The numeric coding system consists of three groups of numbers. In sequence, the groups represent response classification, incident type and zone of incident. For details and examples see Appendix 2.

A numeric code message may also be sent from any phone.

See [Appendix 4](#) for a description of the numeric paging codes for emergency situations.

DOCUMENT NO:	HSE-EAP-008	PAGE:	7 OF 15
DOCUMENT NAME: COMMUNICATIONS			

TELEPHONE SYSTEMS

The facility telephone and cellular phone systems provide a key means of communication with both internal and external stakeholders. Utilization of telephone and cellular lines during an emergency assists in keeping radio frequencies open for emergency radio traffic.

In the event of power failure, the plant telephone system is provided with emergency power. The system will shift back to normal power upon system restoration.

Various Telephone Lists to include the refinery phone system, fax machines, EOC phones, CCRB phones, Command Van cell phones numbers, outside line phone numbers and the Emergency network System phone numbers are accessible from the [EOC Website](#).

Outside Telephone Lines

In the event of a total telephone system failure, EOC is provided with six (6) outside telephone lines that are independent of the plant telephone system. These phones are labeled as "Outside Line".

Emergency Network System

As an additional backup and in the event local telephone service is overloaded, telephones attached to the Deer Park Emergency Network System may be used. These phones are located in EOC and are labeled as "Emergency Network System". The emergency Network System phone numbers and locations are available on the [EOC Website](#).

Emergency Notification Manual

The Emergency Management Database contains a telephone number listing of entities that may need to be contacted to provide assistance, or otherwise be notified in the event of an emergency.

In case of information system failure, hardcopy *Emergency Notification Manuals* are provided in the following locations:

- MainGate Dispatch
- Emergency Operations Center (EOC)
- Field Command Post
- Plant Shift Superintendents Office.

DOCUMENT NO:	HSE-EAP-008	PAGE:	8 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

EMPLOYEE COMMUNICATIONS

Refinery Emergency Information Line

Additionally, the Refinery Emergency Information Line provides employees and their families an opportunity to call and receive updated information during emergencies or abnormal situations such as weather events. To hear messages on the Emergency Information Line, call:

(713) 321-5775

LyondellBasell Information Line

In the event local phone service is not available, employees and their families may call the LyondellBasell Information Line to obtain emergency or abnormal situation updates. To access the LyondellBasell Information Line, call :

1 (888) 457-6118

- Press 2 and then 6 to access HRO, then
- Press 1 to hear an update on plant status
- Press 2 to leave your contact information / location
- Press 3 to leave a message or ask a question and receive a return call

www.hrohome.com

The Internet website www.hrohome.com has been established as a mechanism for two-way, interactive communication between refinery management and employees. Although primarily established for hurricane evacuation situations, hrohome.com may be activated for other types of abnormal situations. To access the website:

- go to www.hrohome.com from any Internet capable device
- Login with your normal Network Logon ID
- Utilize the last four digits of the SSN as the Password

General information including site status and return to work requirements are provided in the Site Status tab at the top of the page.

Employees can provide information on their status, location and contact information via the Adverse Condition Reporting tab at the top of the page.

hrocheckin@lyondellbasell.com

As a last resort in the event employees are unable to contact their supervisor or another refinery contact person, employees may send an email or text message with their personal status and location, or a location a question or concern to hrocheckin@lyondellbasell.com.

DOCUMENT NO:	HSE-EAP-008	PAGE:	9 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-008	PAGE:	10 OF 15
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(b) (7)(F), (b) (3)

DOCUMENT NO:	HSE-EAP-008	PAGE:	11 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-008	PAGE:	12 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

APPENDIX 4:

NUMERIC PAGING CODES FOR EMERGENCIES

The numeric paging codes are sent from an autodial system at Maingate Dispatch or any phone line. This system is a backup to the alphanumeric systems. The codes are sent in three groups of numbers. The following describes each group and the meaning of the numbers displayed:

First Three Numbers:

Response Classification

- Alert 1: 111
- Alert 2: 222
- Alert 3: 333
- Alert 4: 444
- Alert 5: 555

Second Two Numbers:

Type of Emergency

- Fire: 111
- Gas Release: 222
- Spill: 333
- Medical: 444
- Rescue: 555

Third Three Numbers: (Optional if in Operating Unit, Area or Tank Farm)

Location of Emergency

- Process Unit or Area Number Examples: 536, 732, 533
- Tank Number Examples: 688, 564

Examples:

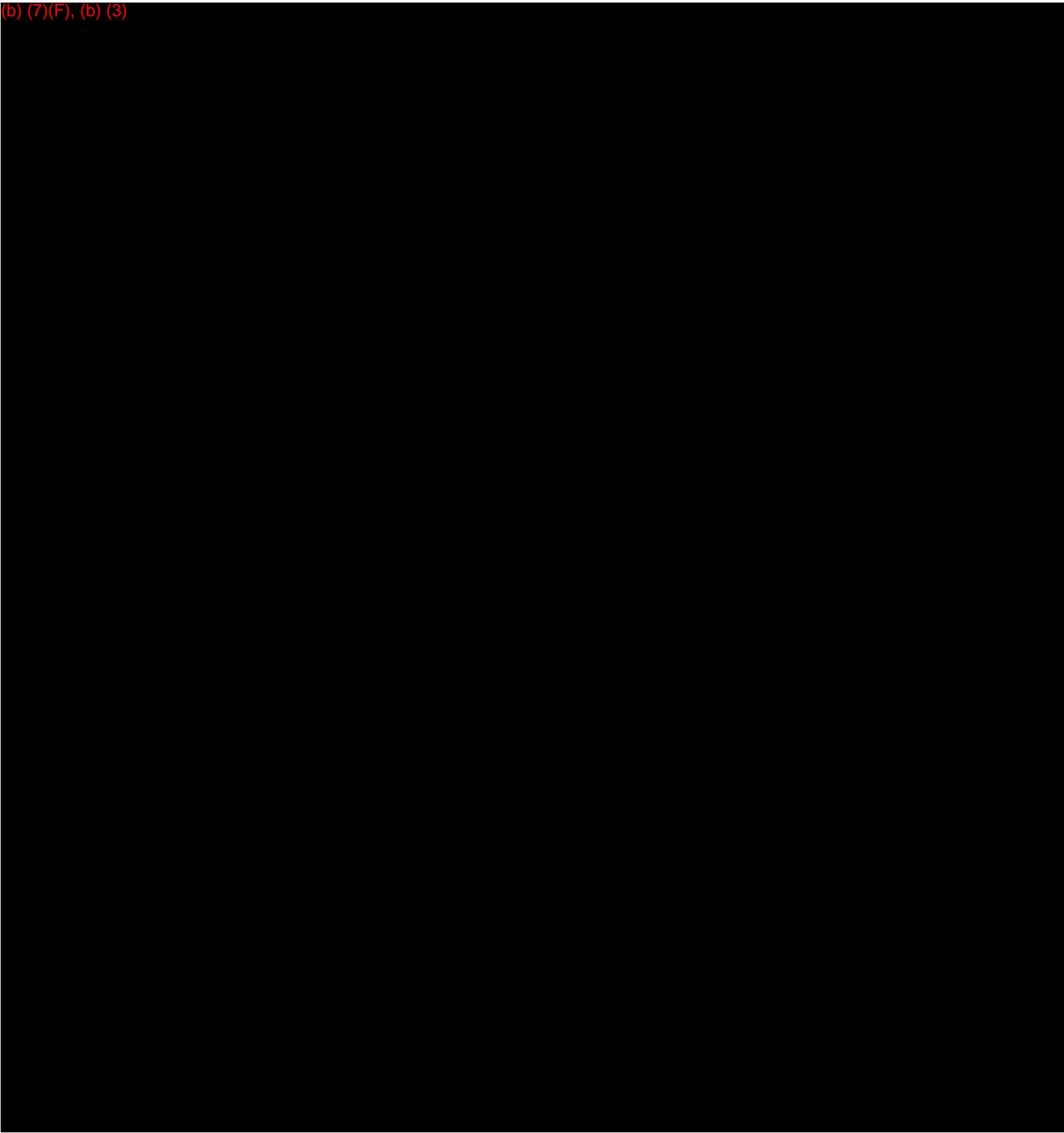
- Alert 1 Fire 536 Crude Still: 111-111-536
- Alert 2 Fire 735 Magnaformer: 222-111-735
- Alert 3 Three Medical 636 Reformer: 333-444-636

DOCUMENT NO:	HSE-EAP-008	PAGE:	13 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

APPENDIX 5

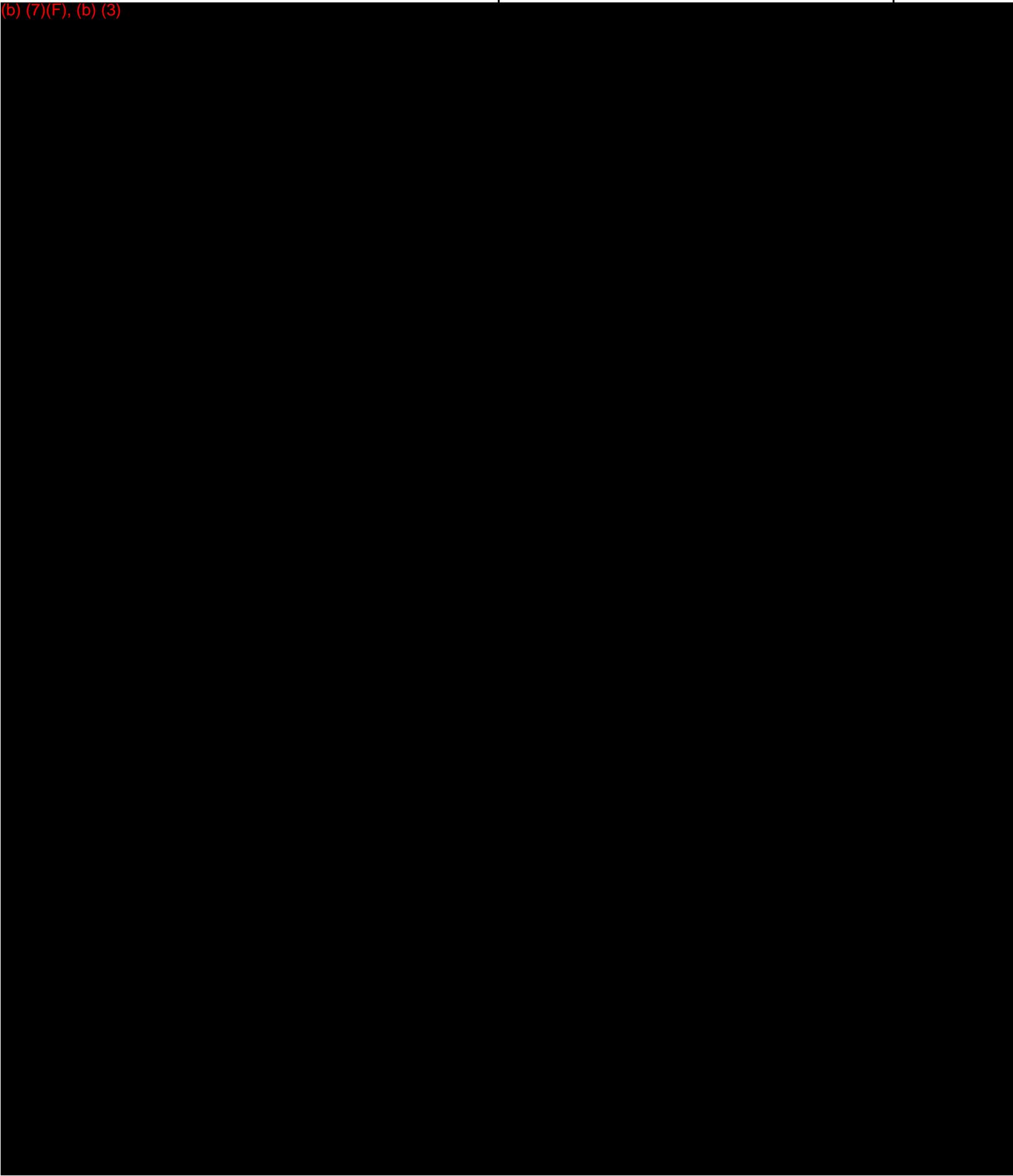
HOUSTON REFINERY RADIO SYSTEM TALKGROUPS

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-008	PAGE:	14 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

(b) (7)(F), (b) (3)



DOCUMENT NO:	HSE-EAP-008	PAGE:	15 OF 15
DOCUMENT NAME:			
COMMUNICATIONS			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date

HOUSTON Refining LP	DOCUMENT NUMBER:	HSE-EAP-010	Page: 1 OF 32	Approval Date:	06/30/2011
Document Title:	OUTSIDE RESOURCES AND MUTUAL AID				
Approver: CHRIS MATTHEWS	<i>Electronic Signature On File</i>		Effective Date:	07/01/2011	
Document Owner: Jeff Windham	<i>Electronic Signature On File</i>		Review Date:	02/24/2011	

TABLE OF CONTENTS

Summary	2
Procedure	2
CIMA	2
Local Fire Departments	11
Emergency Medical and Rescue Services	14
Law Enforcement	17
Staging Areas and Landing Zones	20
Railroad Traffic Control	27
Appendix 1	28
Appendix 2	29
Appendix 3	30
Appendix 4	31
Revision Summary	32

DOCUMENT NO:	HSE-EAP-014	PAGE:	2 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

SUMMARY

The following describes procedures for the request and management of outside or mutual aid resources for emergencies. Additionally, the plan provides procedures for refinery responses to mutual aid requests (requests for refinery emergency resources).

CIMA Mutual aid resources are activated during Alert 4 Emergencies. However, limited requests for outside support may be made without the issuance of an Alert 4.

The Houston Refinery is located in the City of Houston. However, it is bordered on the east side by the City of Pasadena. Therefore, a multi-city response is possible dependent on the location and significance of the incident.

Due to the refinery being located in the City of Houston, the Houston Fire Department may be notified and requested to respond during an Alert 2 or greater event. This notice does not constitute an Alert 4 condition.

For a complete list of contact numbers see the Emergency Notification Manual.

CHANNEL INDUSTRIES MUTUAL AID (CIMA)

The Channel Industries Mutual Aid (CIMA) organization is an emergency response mutual aid group. The organization represents the joining together of over one hundred Houston Ship Channel area industries, government agencies and municipalities for the purpose of providing firefighting, rescue and emergency medical assistance for emergency situations -- either natural or man-made.

CIMA Zones

CIMA is divided into four (4) geographic zones:

- Zone 1 - All areas north of the Houston Ship Channel and the northern shore of Galveston Bay.
- Zone 2 - Area south of the Houston Ship Channel, west to downtown Houston, east to Beltway 8 and all areas south of the above mentioned boundaries.
- Zone 3 - Area south of the Houston Ship Channel and east of Beltway 8, south to Spencer Highway and east to the City of La Porte west city limits.
- Zone 4 - Area south of Spencer Highway, west to Beltway 8, east to the Galveston Bay Shores of the cities of Morgan's Point, La Porte, Shoreacres, Pasadena and Seabrook, and south to Interstate 45.

THE HOUSTON REFINERY IS LOCATED IN ZONE 2

DOCUMENT NO:	HSE-EAP-014	PAGE:	3 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Classifications of CIMA Emergencies

Fires or emergencies of different magnitudes are roughly classified below under the call designation which will be used on the CIMA Radio System. Members must understand the classifications of emergencies and the operations of the Zone system, and have planned for emergencies so the proper calls can be made in each instance.

Special Call

This call is issued in the form of a request for specific pieces of equipment, or manpower crews not to exceed a total of 2 pieces of equipment / crews. A Special Call also results in the response of one CIMA Officer, but DOES NOT automatically activate the CIMA Specialists and Command Van response.

Standby

A CIMA Standby is for an emergency event that is currently being managed with in-plant manpower and equipment, but which has the potential to develop into a larger emergency requiring outside assistance. This call activates the CIMA Specialists, Officer's and Command Van response.

Alarm List Activation

Alarm list activation is used for a fire or emergency which is beyond the control of in-plant manpower and materials to the extent that specific assistance is needed from members in the form of materials, equipment and/or manpower. The stricken company/agency activates a predetermined Alarm List. This call also activates the CIMA Specialists and Command Van response.

- 1st. Alarm Assignment
- 2nd. Alarm Assignment
- 3rd. Alarm Assignment
- MCI 10
- MCI 20
- MCI 30

DOCUMENT NO:	HSE-EAP-014	PAGE:	4 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

All Clear

The “all clear” will be given by the member who issued one of the above calls when the particular emergency condition which promoted the original call no longer exists.

CAER Alert

CIMA members, for expediency in making CAER notifications to neighboring CIMA facilities, may choose to use the CIMA radio system. However, it must be noted that the issuance of a CAER Alert over the CIMA radio system (regardless of the level), is for awareness only and does not constitute a CIMA Alert of any type. No response of the CIMA organization, including CIMA Specialist, is appropriate for a CAER Alert.

Road Block

Several CIMA members have made arrangements with adjacent facilities that upon notification, roads can be quickly blocked by personnel from those facilities until law enforcement can respond. This request can also be made on the CIMA radio system and DOES NOT, in and of itself, constitute a CIMA call of any type.

CIMA Alarm List

CIMA Alarm Lists provide a predetermined response catalogue for CIMA assistance to process events, tank fires, large volume water supply and EMS Mass Casualty (MCI) incidents.

Events that do not cleanly fit into one of the categories above will typically result in assignment of a process fire alarm list response.

The various CIMA Alarm Lists for Houston Refining can be accessed via the CIMA Database on the CIMA Website.

CIMA Radio System

CIMA owns and manages a radio system used by its members for dispatching and communicating. The refinery uses the CIMA radio system for requesting assistance and managing mutual aid responses in the facility. For further information on the CIMA Radio System, see [HSE-EAP-0008 Communications](#).

CIMA Dispatch

CIMA maintains two (2) dispatch centers operated 24-hrs a day in order to provide coverage for CIMA members during emergencies. CIMA dispatch is designated to dispatch Standbys, First Alarm Assistance, and Mass Casualty (MCI) calls.

The primary dispatch center for the Houston Refinery is CIMA Dispatch Baytown. CIMA Dispatch Baytown should be contacted to request a CIMA response to refinery events.

DOCUMENT NO:	HSE-EAP-014	PAGE:	5 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

(b) (7)(F), (b) (3)

Refinery CIMA Representative

A CIMA Representative must be designated for each member facility. The CIMA Representative for a member company is the official contact and voting member representing the organization.

The CIMA Representative and alternates for the refinery are as follows:

- Primary: Fire Chief
- First Alternate: Emergency Management Coordinator
- Second Alternate: Assistant Fire Chief, or designated ERT Officer

CIMA Emergency Response Specialist

CIMA Emergency Response Specialists are designated emergency responders in the organization who immediately report to any Standby or Assistance call for the purpose of supporting the stricken company with managing CIMA resources.

CIMA Assistance Procedures (Request for Assistance)

The Houston Refinery may require CIMA assistance for major emergencies requiring additional manpower and equipment support (Refinery Alert 4 response classification). Limited request for assistance (e.g., Houston Fire Department Emergency Medical Ambulance support), or a CIMA Special Call (request for not more than two (2) CIMA apparatus), may not constitute the issuance of a refinery Alert 4.

The following procedures outline the process for requesting and managing CIMA resources in the refinery.

DOCUMENT NO:	HSE-EAP-014	PAGE:	6 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Authorization for the Request of CIMA Assistance

Any standby or assistance request to CIMA may be authorized by the following personnel:

- Emergency Operations Director
- EOC HSE Coordinator
- Incident Command
- Field Coordinator

Special Call or Alarm List Activation

The Main Gate Dispatcher may be requested to make the initial call. However, most assistance calls will be issued directly from the field command post. All subsequent communications with CIMA will be made by Incident Command.

Procedures for activation are as follows:

- Request for Standby or Assistance call shall be made via phone or over the CIMA Radio System to **CIMA Dispatch Baytown**. The preferable method is by the CIMA Radio System.
- Requests may include, but not be limited to the following:
 - ⇒ Request for Special Call (equipment or manpower)
 - ⇒ Request for Standby
 - ⇒ Request for Alarm List Activation
 - ⇒ Request for CIMA Mass Casualty Incident Response

Managing CIMA Resources

The following steps are to be used for managing CIMA resources entering the facility:

Note: Security will follow applicable Security Procedures when checking CIMA resources into the physical boundaries of the refinery to ensure compliance with TWIC requirements

- Incident Command shall designate which staging area will be used and assign a Staging Area Manager from Houston Refining.
- On arrival and assignment of CIMA resources into operational positions, Incident Command **shall give direction to move all emergency response radio traffic to the appropriate CIMA tactical channel talk group.**
- The Staging Area Manager will work with the EOC Security Coordinator to formulate plans for attaining plant resources required to escort CIMA resources from Staging to the respective assignment. The Staging Area Manager will document all incoming CIMA resources and shall track their assignment on the Staging Log.

DOCUMENT NO:	HSE-EAP-014	PAGE:	7 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- The first CIMA Specialist arriving at the facility will be escorted to Incident Command at the Field Command Post.
 - The second arriving CIMA Specialist will typically be assigned to Staging.
 - Incident Command may request that additional CIMA resources be dispatched by a CIMA Specialist designated as CIMA Dispatch.
 - All other CIMA Specialists will report to the Staging Area for assignment. CIMA Specialists will typically be assigned as follows:
 - ⇒ Field Command Post – CIMA Incident Command Liaison
 - ⇒ Staging Area Manager
 - ⇒ Operations Section Chief
 - ⇒ Planning Section Chief
 - ⇒ Division / Group Supervisor(s)
- CIMA Specialists will often be assigned to Houston Refining Emergency Response Officers to assist and liaison with CIMA resources.
- An All Clear for the CIMA request shall be given by Incident Command after all CIMA resources have been decommissioned and returned to service.

CIMA Assistance Procedures -- Rendering Mutual Aid

The Houston Refinery is listed on many CIMA member company and municipal agency alarm lists. The following procedure shall be followed to allow for a prompt assistance call response.

CIMA Standbys and Alerts will be received primarily over the CIMA Radio System. Main Gate Dispatch is responsible for monitoring the CIMA radio on a 24-hr basis and notifying the appropriate personnel as stated in this procedure. Main Gate Dispatch will maintain a current catalogue of member company alarm lists which include Houston Refinery resources.

Personnel Authorized To Release Resources for CIMA

The listed personnel are authorized to release refinery resources for CIMA Assistance Calls.

- Plant Shift Superintendent
- Refinery RLT Member
- Fire Chief
- Assistant Fire Chief
- Emergency Management Coordinator

DOCUMENT NO:	HSE-EAP-014	PAGE:	8 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

CIMA Standby

- On receipt of a CIMA Standby for any zone, the Main Gate Dispatcher shall notify:
 - ⇒ the ERT Officers
 - ⇒ ERT Members on-site
 - ⇒ the Plant Shift Superintendent

These notifications should be made via:

- ⇒ the Emergency Management Pager System, and
- ⇒ the Announce Frequency of the Radio Notification System
- ⇒ Telephone

These notifications shall include as much of the following information as is available:

- ⇒ Stricken facilities name
 - ⇒ Address
 - ⇒ Zone number
 - ⇒ Type of incident (if available)
 - ⇒ Other applicable information (i.e., Houston Refining is on the 1st Alarm)
- Refinery CIMA Specialist(s) shall respond directly to the stricken facility according to CIMA response procedures.
 - The Shift Commander on duty will assemble a standby crew when:
 - ⇒ The Standby is issued for Zone 2.
 - ⇒ A Standby is issued for a member company which lists refinery resources on their first or second alarms.
 - ⇒ A significant event exists that will most surely involve a refinery response.
 - The standby crew should pick up the requested equipment and assemble at the facility Main Gate

*The Officer in charge of the crew should be the ranking Officer from the respective discipline or equipment requested. *Example: Foam Engine 3, Sr. Captain - Fire Suppression; Hazmat Unit, Sr. Captain - Hazmat.* Ranking Officers may assign or take charge of respective crews.
 - The Standby Crew shall remain at the facility Main Gate until called to respond, released, or an All Clear is issued.

DOCUMENT NO:	HSE-EAP-014	PAGE:	9 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

CIMA Special Call or Alarm List Activation

The following procedures shall be followed when a request for refinery resources is received:

- On receipt of a CIMA request for assistance, the Main Gate Dispatcher shall notify:
 - ⇒ The ERT Officer's
 - ⇒ ERT Members on-site
 - ⇒ The Plant Shift Superintendent

These notifications should be made via

- ⇒ The Emergency Management Pager System
- ⇒ The Announce Frequency of the Radio Notification System
- ⇒ Telephone

These notifications shall include as much of the following information as is available:

- ⇒ Stricken facility's name
 - ⇒ Address
 - ⇒ Zone number
 - ⇒ Type of incident (if available)
 - ⇒ Refinery resources being requested
 - ⇒ Other applicable information (i.e., Shell has issued a 1st Alarm, and Houston Refining is one the 2nd Alarm)
- Refinery CIMA Specialist(s) shall respond directly to the stricken facility according to CIMA response procedures.
 - The Shift Commander on duty will assemble a response or standby crew as appropriate when:
 - ⇒ Refinery resources are requested to respond.
 - ⇒ Refinery resources are listed on the next Alarm level
 - ⇒ A significant emergency exists that will most surely involve a refinery response.

*The Officer in charge of the crew should be the ranking Officer from the respective discipline or equipment requested. *Example: Foam Engine 3, Sr. Captain - Fire Suppression; Hazmat Unit, Sr. Captain - Hazmat.* Ranking Officers may assign or take charge of respective crews.

Response Procedures

The following procedures shall be followed when responding to a CIMA Assistance Call:

- The CIMA Crew Officer will be responsible for:

DOCUMENT NO:	HSE-EAP-014	PAGE:	10 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- ⇒ Providing crew leadership and supervision.
 - ⇒ All equipment and resources used at the scene.
 - ⇒ Crew safety and health.
 - ⇒ All radio communications with CIMA units and the Main Gate Dispatcher.
 - ⇒ On scene communications with CIMA tactical officers.
- If multiple apparatus are requested to respond in the *Off Hours*:
 - ⇒ The most necessary apparatus will be responded first by ERT Members on-site.
 - ⇒ Additional apparatus or equipment will be staffed by off-site ERT members.
 - The Plant Shift Superintendent **must** be notified when equipment leaves the facility.
 - In accordance with CIMA standard operating procedures:
 - ⇒ All response personnel must have full turnout gear and SCBA. The exception is personnel responding to an EMS assistance call on Medic 1.
 - ⇒ A minimum crew of four (4) personnel is required on an apparatus. A minimum crew of two (2) personnel is required on Medic 1.
 - ⇒ Responding personnel must have CIMA radio communications. The CIMA patch may be utilized as necessary. (See **Communications.**)
 - ⇒ Responding resources shall announce their response over CIMA Channel C1 (i.e., "Lyondell Houston Aerial 1 Responding")
 - For some responses, it may be necessary to respond with a support vehicle with appropriate state required emergency warning devices.
 - All response procedures as stated in CIMA standard operating procedures will be followed.

Other Considerations

- The refinery status must always be considered when responding to outside emergencies. **The refinery must be adequately protected.**

In certain instances, it may be prudent to advise another CIMA member facility to place a crew on standby to assist in plant protection while refinery special equipment and personnel are committed.
- If a refinery Alert is issued while refinery resources are committed to a CIMA Assistance Call, the Team Leader and Refinery CIMA Response Specialists shall evaluate the Alert and request a release from the outside scene as deemed necessary.

DOCUMENT NO:	HSE-EAP-014	PAGE:	11 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- Most requests for refinery resources will be for a single apparatus and crew only. However, a significant disaster may require a second team and further apparatus to respond. The Houston Refinery is on several member companies' alarm lists with a request for multiple apparatuses.
- Consideration must always be given to properly relieving crews for long duration events. The Shift commander on duty will coordinate assignment of relief crews.

CIMA Member Companies and Agencies

Names, telephone numbers, alarm lists, and equipment lists for CIMA members are listed in the **CIMA DATABASE on the CIMA WEBSITE**.

For further details concerning CIMA procedures and resource lists see the CIMA WEBSITE.

FIRE PROTECTION: LOCAL FIRE DEPARTMENTS

Although they are members of CIMA, two municipal fire fighting organizations and the Houston Port Authority are available to assist with facility fire protection.

For CIMA fire protection capabilities see **Channel Industries Mutual Aid**.

Houston Fire Department

The Houston Fire Department (HFD) has primary fire suppression jurisdiction for the Houston Refinery.

At Incident Command's discretion, HFD may be notified and requested to respond during the activation of an Alert 2 incident. HFD will automatically be called for an Alert 3 or greater – Fire, Spill, or Gas Release.

The Houston Fire Department will also be contacted for emergency medical services (EMS). See **Emergency Medical Services Plan**.

Houston Fire Department Procedures

- The first arriving or HFD Command Officer and his respective unit (District Chief, Captain, or apparatus officer) shall be escorted directly to Incident Command at the Command Post.
- All other apparatus shall be instructed to stage on Lawndale (Initial Staging Area) until instructed to move up to an in-plant Staging Area (CIMA Staging Area). ER - Command may assign a Houston Refining Staging Area Manager to organize the staging effort (see Staging Officer).
- Per HFD Command's request, a liaison through the Houston Fire Department's Hazardous Materials Response Team (HM-22) may be organized.

DOCUMENT NO:	HSE-EAP-014	PAGE:	12 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- HFD resources shall be utilized by Command as deemed necessary. Additional resources may be requested.
- A unified command structure may be organized as necessary.
- An HFD Officer will be requested to stay at the Command Post until the event is under control.

Pasadena Fire Department

With the exception of the (b) (7)(F), (b) (3) [REDACTED], the refinery is not in the immediate jurisdiction of the Pasadena Fire Department (PFD). However, refinery emergencies may affect the City of Pasadena or PFD may be responding due to a citizen report.

Pasadena Fire Department Procedures

- The first arriving or PFD Command Officer and his respective unit (District Chief, Captain, or apparatus officer) shall be escorted directly to Incident Command at the Command Post.
- All other apparatus shall be instructed to stage on Lawndale (Initial Staging Area) until instructed to move up to an in-plant Staging Area (CIMA Staging Area). Command may assign a Houston Refining Staging Area Manager to organize the staging effort (see Staging Officer).
- The PFD Command Officer will be informed concerning the emergency. If the event impacts the City of Pasadena, the officer will be requested to stay at the Command Post until the event is under control. PFD resources may be requested by Command as deemed necessary. Additional resources may be requested.
- A unified command structure may be organized as necessary.

Houston Port Authority Fire Department

The Houston Port Authority Fire Department operates three (3) Fire Boats on the Houston Ship Channel. The Port Authority has jurisdiction on the Houston Ship Channel shoreline with boundaries from the turning basin to the Bayport Channel. These Fire Boats are available for waterfront and ship / barge firefighting support. The fire boats also have the capabilities of supplying water to the refinery fire water system.

Fire Boat assistance may be requested through the:

- **Port Authority Dispatch (713) 670-2647 (primary number)**
- CIMA Dispatch, CIMA Channel C1 - Dispatch
- Houston Fire Department Dispatch.

DOCUMENT NO:	HSE-EAP-014	PAGE:	13 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Fire Boat Procedures for Ship or Dock Fire

- Responding Fire Boats will monitor CIMA Channel C1 - Dispatch.
- In route, the Fire Boats shall be advised at which dock the emergency is located and all hazards involved.
- When the Fire Boat arrives, a Houston Refinery ERT Officer shall be placed on the vessel as soon as practical. This will allow enhanced radio communications with Incident Command.
- If possible, a senior Officer with the Port Authority shall be requested to stay at the Command Post until the event is under control.
- A unified command structure may be organized as necessary.

NOTE: Fire protection for ship and barge fires is not the direct responsibility of Houston Refinery. The Houston Refinery may support vessel fire efforts and will initiate action necessary to protect the Houston Refinery dock and shoreline facilities.

Fire Boat Procedures for Water Supply

- Responding Fire Boats will monitor CIMA Channel C1 - Dispatch.
- In route, the Fire Boats shall be advised at which dock to report.
- When the Fire Boat arrives, a Houston Refinery ERT Officer shall meet the vessel at the docks and assist in supply line connection and for communication with Incident Command.
- 5" Storz supply lines shall be used if possible. 2.5" NST supply lines may be used, but are not preferred. Enough supply lines shall be set up to provide for full pumping capacity of the Fire Boat. An in-line bleeder should be used to evacuate supply lines when removing them from service.
- Water flow should be opened and closed slowly to prevent piping damage to boats and associated refinery equipment.
- If Fire Boat master streams are utilized, adjacent electrical equipment shall be isolated.
- Rehabilitation for Fire Boat Crews should be considered.

DOCUMENT NO:	HSE-EAP-014	PAGE:	14 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

EMERGENCY MEDICAL AND RESCUE SERVICES

Emergency Medical Services (EMS) are available from the Houston Fire Department and Memorial-Hermann Hospital Lifelight (Medivac). CIMA resources are available for mass casualty events.

For CIMA Mass Casualty Incident Plan management and available Rescue Resources, see the **CIMA WEBSITE**.

Houston Fire Department Emergency Medical and Rescue Services

The Houston Fire Department (HFD) has secondary EMS and Rescue duty responsibilities for the Houston Refinery.

The Houston Fire Department will be contacted for emergency medical services (EMS) requiring transportation by outside ambulance to area hospitals.

The HFD EMS Division responds (dispatches units) on a tiered system dependent on the type of emergency. Therefore, the type of assistance received is directly related to patient information provided to the HFD Dispatcher.

HFD EMS and Rescue responses may include but not be limited to the following:

- Ambulance -- Basic Life Support (BLS) Unit
- Medic Unit -- Advanced Life Support (ALS) Unit
- Engine Company -- Engine Company dispatched as first responder or to assist Medic Unit on life-threatening incidents, i.e., CPR in progress.
- Ladder Company -- Ladder trucks provide first responder and light rescue capabilities, and may respond to assist in EMS / rescue operations.
- Heavy Rescue Unit -- Rescue unit staffed and equipped for high angle, confined space, and trench rescue.

Houston Fire Department EMS and Rescue Procedures

- Incident Command must ensure that adequate patient information is provided to Main Gate Dispatch for HFD EMS requests.
- If an Engine or Ladder Company arrives first, they will be escorted to the scene upon direction from Command.
- Ambulances, medic units, EMS Supervisors, or rescue units shall be escorted to the scene as directed by Command.
- Other HFD resources shall be utilized by Command as deemed necessary. Additional resources may be requested if necessary. Additional HFD resources will be directed to stage on Lawndale or in the CIMA Staging Area.

DOCUMENT NO:	HSE-EAP-014	PAGE:	15 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

- A unified command structure may be organized as necessary for mass casualty incidents.
- Adequate patient information shall be provided to the HFD EMS Officer in charge. This information should be in writing (see EMS Form in EAP volume titled **ADMINISTRATIVE PLANS**) and reviewed directly with the Officer. During this transition process, communications are critical.
- For mass casualty incidents, an HFD Command Officer will be requested to stay with Command at the Field Command Post. Additional HFD EMS Officers may be assigned to or assist the Triage, Treatment and Transport Unit Leader(s).

Lifelight - Memorial-Hermann Hospital

Primary medivac operations are conducted by Memorial-Hermann Hospital Lifelight. Lifelight helicopters deliver EMS personnel to the scene and provide expedient transportation to the trauma center at Memorial-Hermann Hospital.

The requesting of Lifelight may be, but is not limited to, the following types of emergency medical incidents:

- Multi-system Trauma
- Large percent burns
- Burns to specific body regions
- Severe head/neck injuries

Helicopter Landing Zones

Helicopter Landing Zones have been designated for the refinery. These Landing Zones may be used to support medivac (Lifelight) and other emergency helicopter operations. Helicopter Landing Zones are designated as one of the following:

- Heliports
- Designated Landing Zones (LZ)

LANDING ZONE	LOCATION
Heliport	East side of Gate 3 (Main Gate)
Heliport	Northeast side of the facility between the Ship Channel and the East Guard Basin
Designated Landing Zone	Designated location on Lawndale Street

ER - Command may alter and set up additional Landing Zones as circumstances require.

DOCUMENT NO:	HSE-EAP-014	PAGE:	16 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

Heliport Procedures

A heliport is an area of land used for helicopter landing and takeoff operations. For the purpose of this document, this area is permanently marked and designed for the intended use.

The following procedures should be followed when using heliports:

- Mark the LZ:

During night operations, if the area does not have designation lighting, the area shall be marked by flares or portable strobe lights.
- Incident Command shall ensure that the heliport is secured from unauthorized personnel.
- Establish ground contact with landing aircraft. Incident Command shall be ground contact unless this duty is assigned to another officer.
- *For heliports a fire/rescue standby is not required.*

Designated Landing Zone Procedures

Designated Landing Zones are temporary areas established for helicopter landing and takeoff operations.

The following procedures should be followed to set up a safe landing zone for helicopter operations:

- Determine the location of the LZ:

If possible all LZ locations should be on a hard paved surface. All refinery pre-determined locations are on a paved surface.

The LZ must be: **60' square (Day)**
 100' square (Night)

For LZ diagram see [Attachment 3: Landing Zone Operations](#).

If a dust hazard exists, the area may be lightly wetted down.
- Mark the LZ:

The LZ shall be marked by flares or portable strobe lights. Fluorescent orange cones may be used during the day.
- Establish ground contact with landing aircraft. Incident Command shall be ground contact unless this duty is assigned to another officer.

DOCUMENT NO:	HSE-EAP-014	PAGE:	17 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Ground to Air Contact

PRIMARY

SECONDARY

(b) (7)(F), (b) (3)

Medivac Helicopter units may not land without a confirmed ground contact.

- Communicate LZ location and hazard information.

Advise the pilot of the following conditions:

- ⇒ Terrain hazards (e.g., level or slope, rocks or brush, paved or dusty roads)
- ⇒ Obstacles (e.g., street signs, vehicles, trees, antennas or utility lines)
- ⇒ Wind direction (e.g., wind direction, flare, portable strobes or marking cones on each corner of LZ with a fifth marking on the upwind side.)

To facilitate LZ safety, a fire and rescue standby should be placed at landing zones as follows:

- A foam pumper staged and readied for immediate fire attack.
- A standby crew of at least two (2) personnel in full turnout gear and SCBA placed for immediate rescue operations.
- All personnel will stage behind the foam engine during landing and take-off.
- At night, turn off all strobe lights on vehicles near the LZ to prevent vision problems for the pilot.
- Do not illuminate the LZ with flood lights to prevent possible blinding of the pilot. Illumination used in the area should be directed towards the ground onto the scene and away from the LZ.
- Approach the helicopter from the front and ONLY when signaled to do so by the pilot or a crew member.

DOCUMENT NO:	HSE-EAP-014	PAGE:	18 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

Medivac (Lifelight) Procedures

Requests for Lifelight, or any other medivac service, should be made to the helicopter dispatcher by phone (landline).

By landline provide the following information:

- Patient information
- Landing location
- Ground contact radio channel and frequency

Proper radio procedures are to await the incoming flight's call for landing instructions and patient information. Previous to this, the pilot will not be monitoring for a ground contact.

- Incident Command must ensure that adequate patient information is provided to Main Gate Dispatch for Lifelight requests.
- Proper Landing Zone (LZ) must be provided and ground contact established.
- On arrival, the Lifelight EMS Officer shall be escorted directly to the scene or to a safe location to await delivery of patient.
- Adequate patient information shall be provided to the Lifelight Officer in charge. This information should be in writing and reviewed directly with the Officer. During this transition process, communication is critical.
- For mass casualty incidents, the refinery incident command system may request to have a Lifelight Medical Officer working with the Triage Unit Leader.

HAZARDOUS MATERIALS RESPONSE - HAZMAT TEAMS

The Houston Fire Department is available to assist with facility hazardous materials spills or releases.

For CIMA Hazmat capabilities see **Channel Industries Mutual Aid**.

Houston Fire Department

The Houston Fire Department (HFD) may provide hazardous materials support with their Hazardous Materials Response Team (HM-22).

HFD will may be notified and requested to respond during the activation of an Alert 2 or greater emergency - Fire, Spill, or Gas Release.

Procedures for Hazardous Materials Response

DOCUMENT NO:	HSE-EAP-014	PAGE:	19 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Due to the nature of the refinery emergencies, procedures to be followed for a HFD Hazmat Response are typically similar to that of a fire suppression response. The Houston Fire Department HAZMAT Team automatically responds with all HFD alarm assignments for fires, spills or releases.

OIL SPILL WATER - OIL SPILL RESPONSE TEAMS

Beyond initial spill containment response and some degree of minor cleanup for marine spills, Houston Refining relies on outside contractors and a spill association to provide material and manpower for complete spill containment, removal of floating spillage, and clean-up of affected areas.

The following contractor and spill association are under contract with Houston Refining.

- Garner Environmental
- Clean Channel Association

A companion document to be used in conjunction with the Emergency Action Plan is the Houston Refining *SPILL RESPONSE AND PREVENTION PLAN*. The Spill Response and Prevention Plan describes how Houston Refining will respond to spills that occur in the facility. These spills can be land-based within the refinery resulting from a variety of operations including, but not limited to, tank or pipeline liquid releases or from liquid spills to water at Houston Refining's Marine Terminal.

For detailed information on outside resources for spill response, see the SPILL RESPONSE AND PREVENTION PLAN (SRPP)

LAW ENFORCEMENT: LOCAL LAW ENFORCEMENT AGENCIES

Several local, state and federal law enforcement agencies provide assistance and govern laws within the facility and surrounding community.

(b) (7)(F), (b) (3)

Law enforcement agencies may be called or may respond to the facility for reasons such as the following:

DOCUMENT NO:	HSE-EAP-014	PAGE:	20 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

- Criminal investigations
- Fire investigations
- Searches
- Serving of warrants
- Crime in progress
- Pursuit of suspect through the facility
- Trespassing violations
- Public safety
- Securing of public roads adjacent to the facility.

Law Enforcement Procedures

Entry into the Facility

- On arrival of any law enforcement official, the **Plant Shift Superintendent, the Manager – Emergency Services & Security, and the Security Supervisor shall be notified**. Depending on the sense of urgency concerning the response, having one of these personnel meet with the law enforcement officials may be beneficial.
- The law enforcement official **should be escorted through the facility** as they request.
- If the law enforcement agency enters the refinery rapidly, e.g., in pursuit of a suspect or to make a felony arrest, Houston Refining Security personnel shall **safely** ensue and observe the actions in order to promote the safety of refinery personnel. Security personnel shall follow all orders of law enforcement personnel under such circumstances.
- Houston Refining Safety and Security personnel shall assist law enforcement personnel for investigations and other requests.
- Responsible attempts should be made to inform officials of refinery safety regulations and hazards.
- For minor investigations, an HSE Security Representative may be the company liaison. For substantial investigations, a liaison or liaison group may be appointed by management. This liaison group may include a representative from legal.

DOCUMENT NO:	HSE-EAP-014	PAGE:	21 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Response To Refinery Emergency Alerts

- The first arriving or Law Enforcement Command Officer shall meet with Security Support or with the Security Coordinator if the Security Supervisor is not on site. Depending on the immediate need for support, the officer may be escorted directly to Incident Command at the Command Post.

The Security Support Unit serves as the primary liaison with law enforcement agencies.

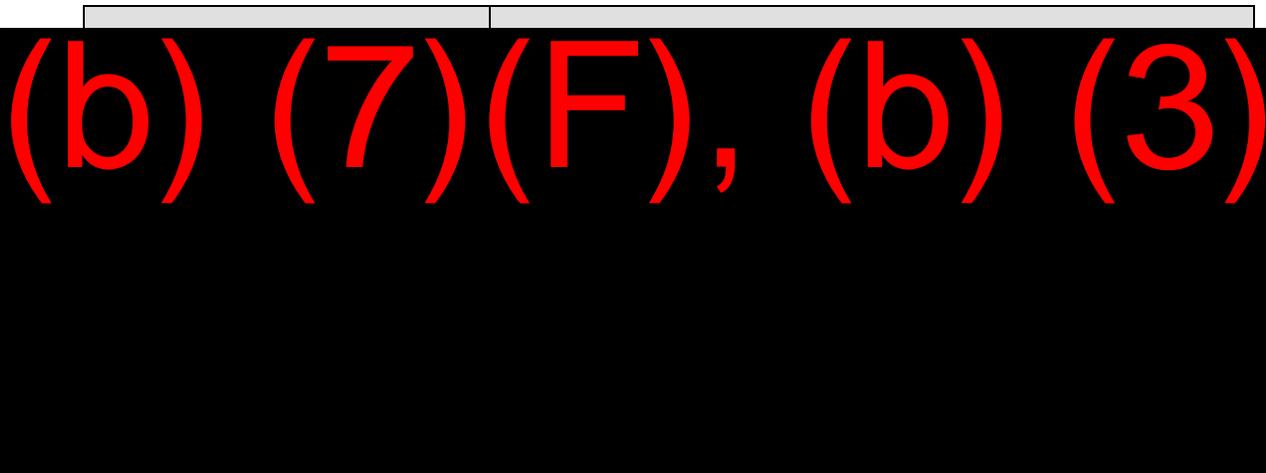
- Law enforcement resources may be utilized by incident Command or Emergency Operations as deemed necessary.
- A unified command structure may be organized as necessary.
- A law enforcement official may be requested to stay at the Command Post or in EOC to assist in managing law enforcement resources.

For securing adjacent off-site roadways, see the [HSE-EAP-004 Emergency Site Security and Control](#).

REFINERY STAGING AREAS

A staging area is established for temporary location of available mutual aid resources on three-minute notice. The staging areas are established by Incident Command to control resources not immediately assigned. The Staging Area Manager manages all aspects of the area. A staging area may include temporary sanitation services and fueling areas. All incoming resources report to staging where they are checked in until requested.

Staging areas for the refinery have been pre-designated to position incoming outside emergency equipment and resources. Incident Command will provide orders on which area to use or may opt to substitute another area as event circumstances require.



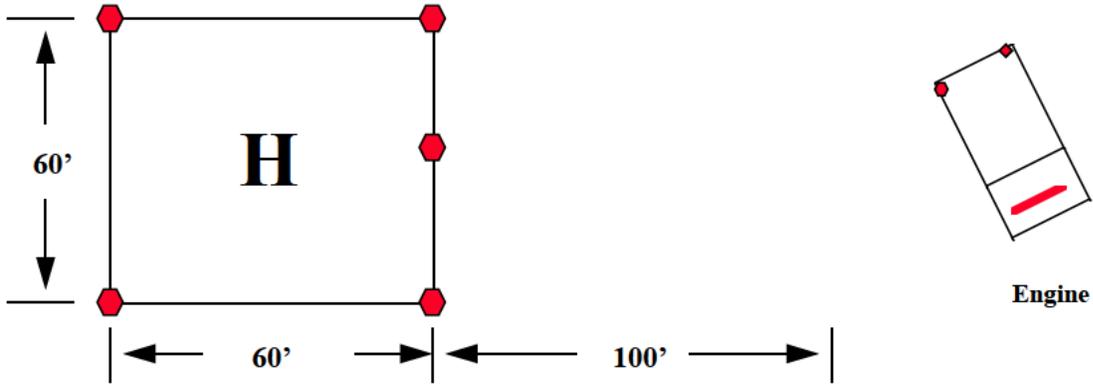
DOCUMENT NO:	HSE-EAP-014	PAGE:	22 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

Pre-designated Refinery Staging Areas are used for emergency equipment staging only. These areas may not be used for any other purpose without the expressed written consent of the Manager, HSE.

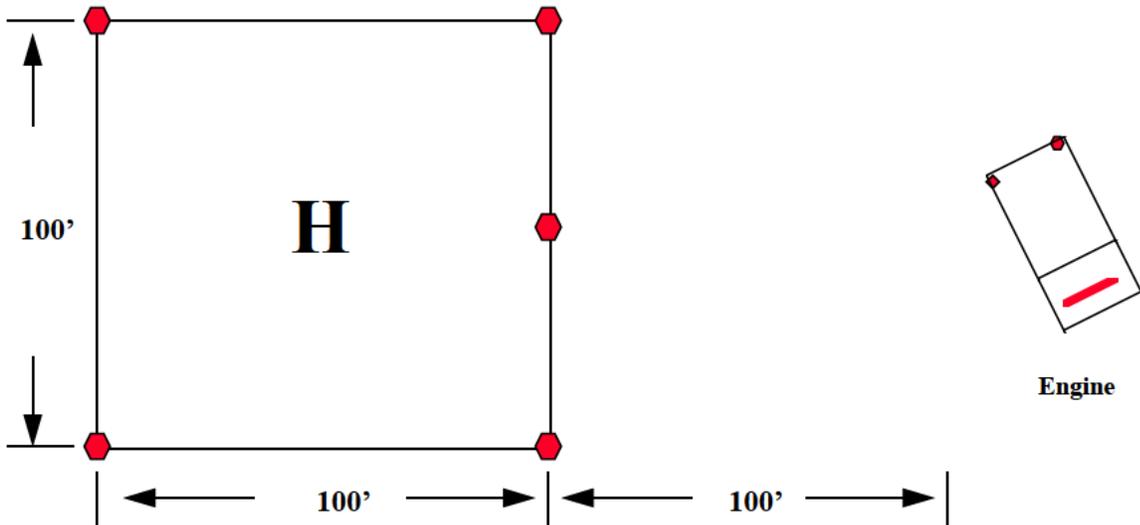
DOCUMENT NO:	HSE-EAP-014	PAGE:	23 OF 24
DOCUMENT NAME: OUTSIDE RESOURCES AND MUTUAL AID			

Attachment 3: Landing Zone Operations

Landing Zone: Day



Landing Zone: Night



DOCUMENT NO:	HSE-EAP-014	PAGE:	24 OF 24
DOCUMENT NAME:			
OUTSIDE RESOURCES AND MUTUAL AID			

REVISION SUMMARY

NOTE: If the changes proposed in this change log are typos or minor grammatical corrections that do NOT affect the intent of the policy only approval from the "Document Owner" is required. All policy intent changes must be approved by the HSSE Manager.

Date	Proposed By	Description of Change	Approved By/Date
2/24/2011	J. Windham	Reformat, reorganize and regulatory review of procedure	

UNIT Channel Industries Mutual Aid	REVISION NUMBER 00	ORIGINATION DATE 20-Dec-06
MANUAL None	PAGE 1 of 4	PRIOR REVISION DATE No Prior Revision
DOCUMENT TITLE Emergency Response Safety Plan (ERSP)	REVIEW Annually	REVISION DATE No Prior Revision
DOCUMENT NUMBER AD-01-024	DOCUMENT AUTHOR(S) Stephen Greco	APPROVER'S SIGNATURE George "Bud" Melder



EMERGENCY RESPONSE SAFETY PLAN (ERSP)

1) PURPOSE

The Emergency Response Safety Plan (ERSP) establishes procedures for monitoring and assessing hazardous and unsafe conditions and for developing methods that help ensure responder safety during CIMA emergencies.

2) SCOPE

This standard operating procedure applies to all incidents that require the activation of a CIMA 1st Alarm assignment or above, MCI event, or Special Operations to another site or municipality that has requested CIMA assistance, regardless of the type of incident (i.e., fire, hazmat, MCI, etc.). This includes the initiation of a response via the Reciprocal Aid Agreement with neighboring mutual aid organizations or the CIMA Non-Member Services Agreement.

This procedure applies to all CIMA industrial and governmental members.

The implementation of the ERSP is not required for a CIMA Stand-by Alarm or Special Call (however, it may be utilized whenever Incident Command requests its use).

The ERSP and its related procedure is for use by CIMA response personnel only and is not to be used as the affected facility's site safety plan required by 29 CFR 1910.120.

3) RESPONSIBILITIES

a) Incident Command

- i) Responsible to ensure that the ERSP is initiated and its' requirements are implemented throughout the incident until the "All-Clear" has been given.
- ii) Ensures that safety procedures and hazard review are a part of the overall strategic objectives for an incident.

b) Incident Safety Officer

- i) Responsible for the ERSP's completion and that its' requirements are communicated and implemented through all levels of the CIMA/NIMS Incident Command System.

c) CIMA Safety Officer

- i) The CIMA Specialist/Technical Specialist assigned to the role of CIMA Safety Officer shall be responsible for the annual review of this procedure and will periodically assess the effectiveness of the use of the ERSP.

UNIT Channel Industries Mutual Aid	REVISION NUMBER 00	ORIGINATION DATE 20-Dec-06
MANUAL None	PAGE 2 of 4	PRIOR REVISION DATE No Prior Revision
DOCUMENT TITLE Emergency Response Safety Plan (ERSP)	REVIEW Annually	REVISION DATE No Prior Revision
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4) **COMPLETION AND IMPLEMENTATION OF THE EMERGENCY RESPONSE SAFETY PLAN (ERSP)** (See [Attachment A](#))

a) **Incident Command**

- i) Appoints **Safety Officer** (Attachment A – **Step 1**)
 - (1) According to **CIMA Specialist** procedures, the third arriving **CIMA Specialist** assumes the **Safety Officer** position unless Incident Command assigns another **Specialist, Technical Specialist** or **IHST** member this position.
- ii) Develops Major Strategic Objectives (Attachment A – **Step 2**)
 - (1) Incident Command shall include safety-related strategies and objectives in the overall strategies for managing the incident.
- iii) Completes Incident Action Plan (Attachment A – **Step 9**)
 - (1) Based on information received from various sources, including the **ERSP**, Incident Command develops an Incident Action Plan (IAP).

b) **Incident Safety Officer**

- i) Initiate TAB1 of **ERSP** (Attachment A – **Step 3**)
 - (1) The **Safety Officer (SO)** ensures completion of TAB1 of the **ERSP** within a reasonable amount of time after initiation of the Incident Command organization.
 - (2) TAB1 of the **ERSP** shall be documented and reviewed with Incident Command.
- ii) Will incident require completion of TAB2 of the **ERSP**? (Attachment A – **Step 4**)
 - (1) **SO** will determine based on the size, complexity, estimated time duration, and response needs of the incident, whether or not TAB2 of the **ERSP** shall be completed.
 - (2) If air monitoring and/or decontamination will be required, then TAB2 will be required to be completed.
- iii) Complete TAB1 (Attachment A – **Step 6**)
 - (1) **SO** ensures that TAB1 is completed and the information reviewed with Incident Command.
- iv) Communicate **ERSP** requirements to Incident Command (Attachment A – **Step 8**)
 - (1) **SO** communicates **ERSP** requirements to Incident Command, and ensures that primary safety-related requirements are included in the overall response strategy for the incident.
 - (2) Incident Command and **SO**, along with the Planning Group for long-term incidents, will establish an implementation plan to complete the requirements of the **ERSP**.

c) **IHST**

- i) Assist **ISO** on completion of **ERSP** TAB2. (Attachment A – **Step 5**)
 - (1) **IHST** will assist the **SO** in completion of the **ERSP** TAB1 and TAB2, as appropriate.
- ii) Complete TAB2 (Attachment A – **Step 7**)
 - (1) **IHST** members are responsible to complete TAB2 of the **ERSP**. **SO** shall communicate any special strategies from Incident Command. **SO** shall provide strategic-related updates to the **IHST** during completion of the **ERSP** TAB2. **IHST** shall continually update air monitoring results and revisions to the **ERSP** TAB2 to the **SO**, as needed.

UNIT Channel Industries Mutual Aid	REVISION NUMBER 00	ORIGINATION DATE 20-Dec-06
MANUAL None	PAGE 3 of 4	PRIOR REVISION DATE No Prior Revision
DOCUMENT TITLE Emergency Response Safety Plan (ERSP)	REVIEW Annually	REVISION DATE No Prior Revision
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d) **Division/Group Supervisor (or Equivalent)**

- i) Implement Incident Action Plan requirements (Attachment A – **Step 10**)
- (1) Division/Group Supervisors (or equivalent) shall implement the requirements of the ERSP, via the Incident Action Plan in the field. IHST members shall assist the Division/Group Supervisors as appropriate.

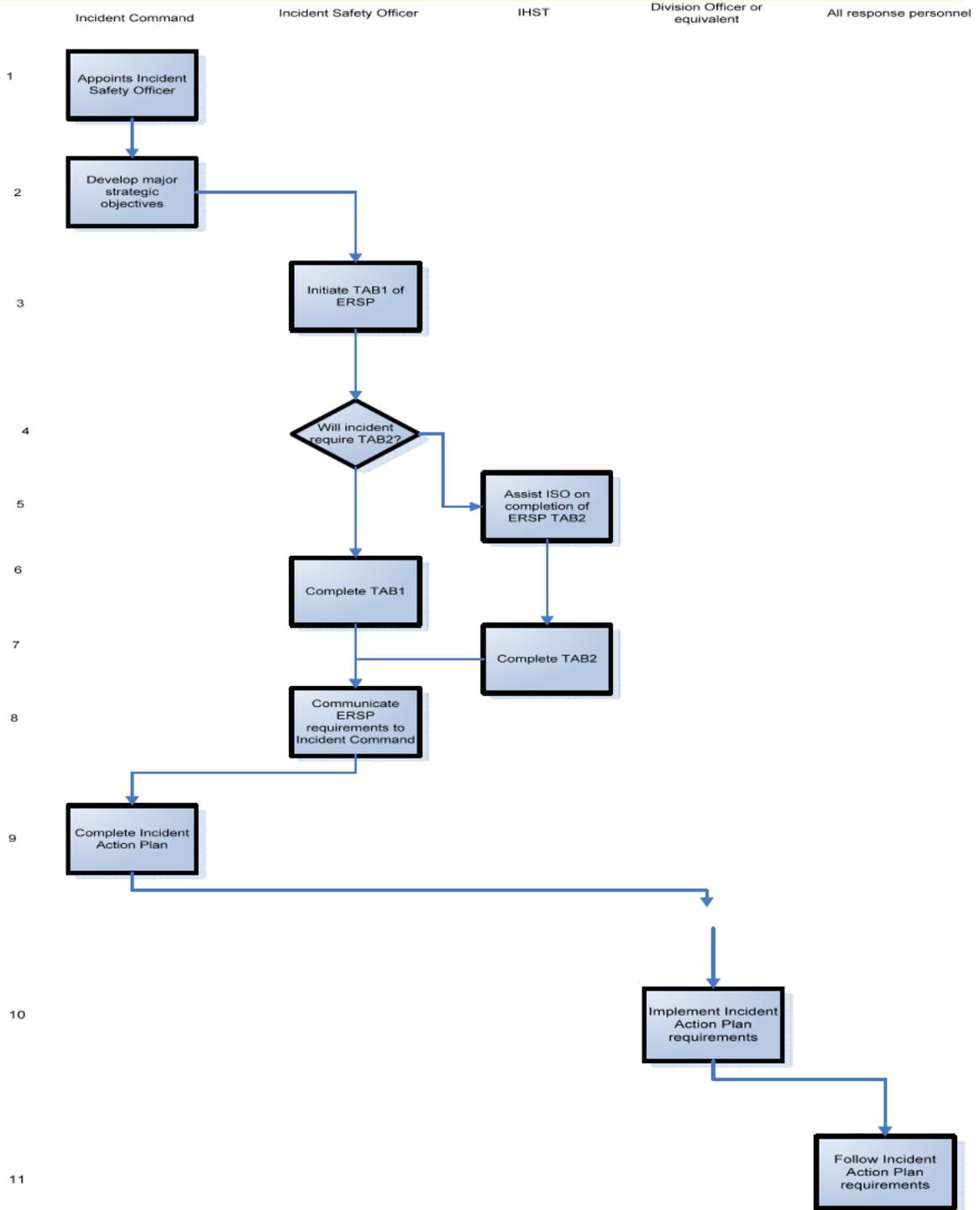
e) **All response personnel**

- i) Follow Incident Action Plan requirements. (Attachment A – **Step 11**)
- (1) All response personnel shall adhere to the requirements of the ERSP.

UNIT Channel Industries Mutual Aid	REVISION NUMBER 00	ORIGINATION DATE 20-Dec-06
MANUAL None	PAGE 4 of 4	PRIOR REVISION DATE No Prior Revision
DOCUMENT TITLE Emergency Response Safety Plan (ERSP)	REVIEW Annually	REVISION DATE No Prior Revision
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5)

ATTACHMENT A





Emergency Response Safety Plan (ERSP)

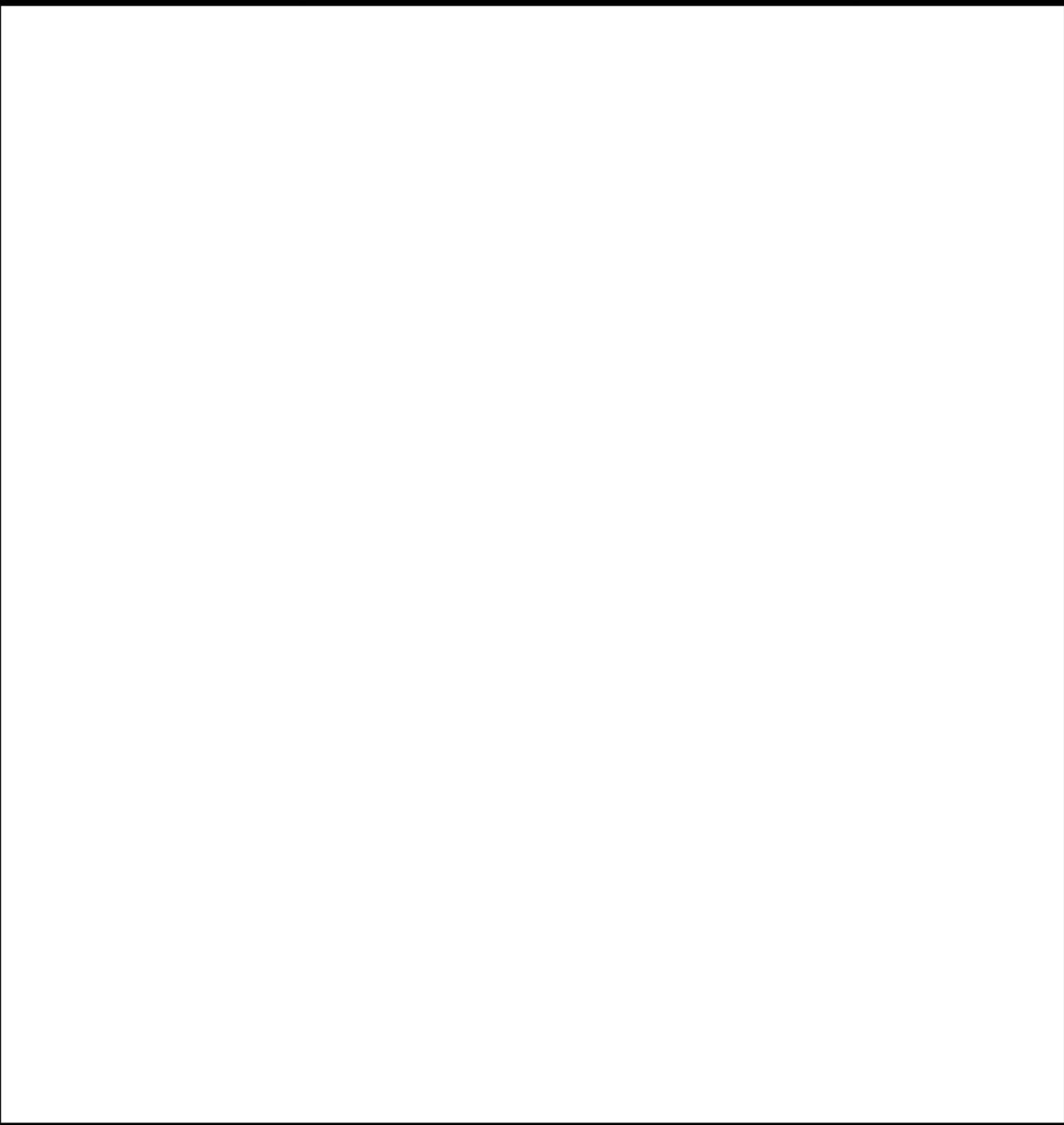
Incident Name:					
Date/Time Prepared:					
Facility Company/Organization:					
Facility Contact:					
CIMA Liaison to Incident Command:					
CIHST Team Leader:					
Describe Type of Incident:	<input type="checkbox"/> Fire	<input type="checkbox"/> Explosion	<input type="checkbox"/> Chemical Release	<input type="checkbox"/> MCI	<input type="checkbox"/> Chemical Spill
	<input type="checkbox"/> Other _____				
Involving Type Of Equipment/Building/Structure/Vehicle:					
<input type="checkbox"/> Process Unit	<input type="checkbox"/> Tank	<input type="checkbox"/> Railcar/Tank Truck	<input type="checkbox"/> Building	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Pressure Vessel
<input type="checkbox"/> Marine Vessel	<input type="checkbox"/> Electrical Substation	<input type="checkbox"/> Other _____			
Describe Site Location And Size Of Incident: _____ _____					
Site Accessible By: <input type="checkbox"/> Land <input type="checkbox"/> Water <input type="checkbox"/> Air					
Draw and/or Describe Zones of Activity (Hot, Warm, and Cold): _____ _____					
Note Location of Incident Command Post:					
Required Activities for the CIMA Incident Safety Officer(s):					
<input type="checkbox"/> All Personnel Have Been Accounted For	<input type="checkbox"/> Level A Back-up Teams in Place				
<input type="checkbox"/> RIT in Place	<input type="checkbox"/> Proper PPE is Used	<input type="checkbox"/> Proper Barricade	<input type="checkbox"/> Obtain MSDS		
<input type="checkbox"/> Control of Non-involved Personnel	<input type="checkbox"/> Buddy System is Used				
<input type="checkbox"/> Accountability System Operational (for CIMA Emergency Response Personnel)					

Last Revision Date: 08/31/03



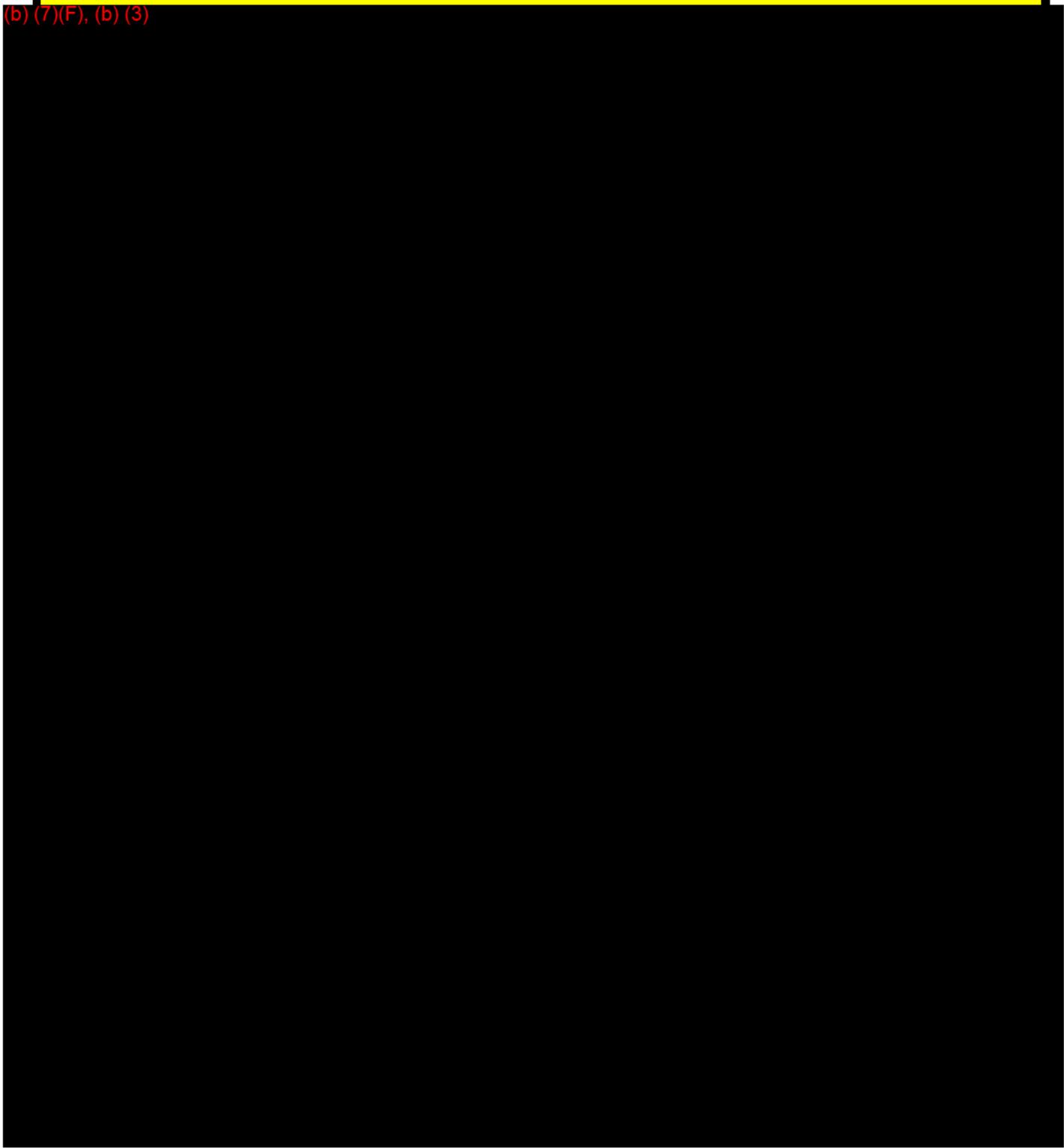
Emergency Response Safety Plan (ERSP)

Sketch Of Emergency Response Work Zones, Security Perimeter, Decontamination Line, Location Of Major Hazards, Evacuation Routes For CIMA Responders, Etc.





(b) (7)(F), (b) (3)





Emergency Response Safety Plan (ERSP)

CIMA IHST AIR MONITORING LOG

Incident Name:	Date:	Sampled By:
Incident Location:	Hazards of Concern:	
Strategy to Conduct Sampling, Assessment and Data Logging of Contaminants: _____		
Monitoring to Establish Hot Zone:		
Fenceline Monitoring:		
Verification of Cold Zone:		
Periodic Monitoring as Conditions Change (Re-verification of Zones):		
Incident Schematic: Draw site plot plan, control zones, and locations of monitoring. Use box , if facility plot plan is not available)		



Emergency Response Safety Plan (ERSP)

CIMA DECONTAMINATION ACTION PLAN

Incident Name: _____ Date: _____ Time Prepared: _____

Incident Safety Officer: _____ Plan Prepared By: _____

Location of Decontamination Station: _____

Hazards Addressed (see Site Safety Plan): _____

Equipment to Decontaminate: _____

Type of Contamination: _____

- Located On Surface Of PPE
- Permeated Into PPE Material
- Exposure To Skin, Eyes, Body
- Located On Equipment

Concentration (est.): _____

Temperature of material (est.): _____

Physical State of Contaminants: _____

Type of Decontamination Station Needed: _____

- Medical Decontamination
- Maximum Level A & B (EPA)
- Maximum Level A, B, & C (EPA)
- Turnout Gear
- Radiation Decontamination

Decontamination Equipment Needed: _____

DIAGRAM OF DECONTAMINATION LAYOUT (sketch):

Texas General Land Office Facility Pre-Audit Checklist

Facility Name	Houston Refining LP	Facility Certificate #	20320
Date of Audit		Time	
Facility Audit Type	<input type="checkbox"/> Small ≤ 1,320 gal. <input type="checkbox"/> Intermediate 1,320-250,000 gal. <input checked="" type="checkbox"/> Large >250,000		

Facility Inspector		Contact Number	
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Facility Database Login:	http://www.glo.texas.gov/cf/facilities-database/index.cfm
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CRITICAL ITEMS – FACILITY ASSESSMENT FORM

Large Facilities	SRPP Cross Reference
Maps/diagrams of facility and surrounding area	Figure 2-1 , Figure 2-2
Notification procedures	§3.4 , EAP
Description of leak detection and safety systems	§2.0 , §5.0
Discharge prevention and response training program	§5.0 , §8.0 , SWP3
Site safety and security plan	§5.1.1 , EAP
Facility response equipment description	§3.0 , Table 3-4 , Figure 3-7 , Figure 3-8
Incident Management protocols	§3.0 , Figure 3-1 , Figure 3-2 , EAP
Site plan showing oil handling structures/drainage pattern	§2.3 , §2.6 , Figure 2-3b
Waste recovery, storage, disposal plans	§5.3 , §5.4 , Table 5-3
Response personnel training records	LiveLink
Emergency medical treatment plan	EAP
Maintenance plan for facility-owned response equipment	§7.0
Statement prohibiting use of dispersants and/or surfactants	§3.3.2 , §5.2.1
Types of oils handled	§2.0 , Table 2-2
Are MSDSs available	MSDS
Worst-case discharge likely to occur	§4.0
Response strategies for worst-case discharge	§3.0 , §5.0 , EAP
Description & maps of environmentally sensitive areas	§5.5 , Figure 5-1
Planning for wildlife rehabilitation	§5.6
Personnel for handling oiled wildlife	§5.6 , Table 3-2
Precautions taken for adjoining properties	§2.2
Site plan indicating locations where oil is stored/transferred	Figure 2-2

During the Audit, a walkthrough and visual inspection of the following items (as applicable) will be conducted:

- | | |
|---|--------------------------|
| ▶ Above ground storage tanks | ▶ Drip pans |
| ▶ Secondary containment and/or berm condition | ▶ Loading arms and hoses |
| ▶ Docks, wharves, transfer stations | ▶ Pipelines |
| ▶ Spill response equipment (e.g. boom, boats, etc.) | ▶ Wells, Platforms |
| ▶ Any other oil handling structures on site | |