



U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue SE
Washington, DC 20590

MAR 13 2015

Mr. Tom Ferguson
Director of Technical Services
Currie Associates, Inc.
10 Hunter Brook Lane
Queensbury, NY 12804

Reference No. 14-0167

Dear Mr. Ferguson:

This is in response to your September 11, 2014 inquiry requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to the classification of a Aqueous hybrid ion rechargeable battery. Specifically, you request confirmation that the Aqueous hybrid ion rechargeable battery described in your letter does not meet the definition of a lithium ion battery and suggest that the requirements of Special Provision 130, applicable to "Batteries, dry, sealed, n.o.s." may be more appropriate.

In accordance with § 173.22, it is the shipper's responsibility to properly classify a hazardous material. This Office generally does not perform this function. However, based on the information you provided relevant to the battery's components and electrolyte, the battery does appear to meet the definition of a lithium ion cell or battery. In section 38.3 of the UN Manual of Tests and Criteria a lithium ion cell or battery is defined as a "rechargeable electrochemical cell or battery in which the positive and negative electrodes are both intercalation compounds (intercalated lithium exists in an ionic or quasi-atomic form with the lattice of the electrode material)..." The battery under consideration uses aqueous electrolyte with a lithium-containing cathode as in the case of "lithium ion cells or batteries," and works on the principle of intercalating lithium ions as well as sodium ions. For these types of batteries, hazards include inherent electrical energy and rise of temperature should short-circuiting occur. In addition, because of the low operating voltages, application of any high voltage for recharging will result in electrolysis of water which generates flammable hydrogen and oxygen. These hazards must be addressed in the classification of aqueous electrolyte based lithium ion cells and batteries.

Special provision 130 applies to dry batteries not specifically covered by another entry in the §172.101 Hazardous Materials Table (HMT). Some similarities in hazard exist between dry batteries and aqueous batteries in terms of electrical energy and short

circuiting potential; however, in our opinion the Aqueous hybrid ion rechargeable battery described in your letter meets the definition of a lithium ion battery and is covered by an entry in the HMT, and therefore would not be eligible for transport in accordance with special provision 130, unless under the terms of a Special Permit.

I hope this satisfies your request.

Sincerely,

A handwritten signature in black ink, reading "Duane A. Pfund". The signature is written in a cursive style with a large, prominent "D" at the beginning.

Duane A. Pfund
International Standards Coordinator
Standards and Rulemaking Division

Wiener
171.1(b), 173.195
Anthony Battery
14-0167

Goodall, Shante CTR (PHMSA)

From: Betts, Charles (PHMSA)
Sent: Friday, September 12, 2014 6:30 AM
To: Dodd, Alice (PHMSA); Goodall, Shante CTR (PHMSA)
Cc: Benedict, Robert (PHMSA); Kelley, Shane (PHMSA); Pfund, Duane (PHMSA); El-Sibaie, Magdy (PHMSA)
Subject: Fw: Request for Letter of Interpretation Regarding Hybrid Ion Battery
Attachments: Aquion Aqueous Hybrid Ion Battery Request.pdf; Attachment 1 - US8298701B2 - Aquion Battery Patent.pdf; Attachment 2 - Aqueous Hybrid Ion Rechargeable Battery SDS.pdf; Attachment 3 - UL1973 Test Results.pdf; Attachment 4 - Abuse Testing Results.pdf; Attachment 5 - Flame Propagation Testing Results.pdf

Please log and assign for response

From: Currie Associates Tom Ferguson [<mailto:tom@currieassociates.com>]
Sent: Thursday, September 11, 2014 05:19 PM Eastern Standard Time
To: El-Sibaie, Magdy (PHMSA)
Cc: Betts, Charles (PHMSA); Kelley, Shane (PHMSA); Michael Eshoo <meshoo@aquion-energy.com>; chris@currieassociates.com <chris@currieassociates.com>
Subject: Request for Letter of Interpretation Regarding Hybrid Ion Battery

Dr. El-Sibaie,

Please find attached a request for a letter of interpretation regarding Aquion's Aqueous Hybrid Ion Battery. We have included product designs and relevant testing reports which describe the product and identify the minimal risk of this technology in transport. Our client plans to ship the battery with all safety precautions necessary, however, the technology does not clearly fit into any existing descriptions. We request that PHMSA consider the information provided and suggest guidance on how the battery should be prepared for transport.

Aquion and Currie Associates are available for comment should your office have any questions, either electronically, by teleconference, or in person. Please do not hesitate to contact us for any reason.

Thank you for your consideration of this issue.

Best Regards,

Tom Ferguson, PG, CHMM, DGSA
Director of Technical Services
Currie Associates, Inc.
10 Hunter Brook Lane
Queensbury, NY 12804
O: 770-486-5603
F: 518-792-7781

This information is intended to provide interpretative and authoritative information in regard to the subject matter covered as a service to our members and has been answered to the best of our ability based on the information provided to us. We do not guarantee the accuracy or completeness of any such interpretation or information, however, nor do we warrant that compliance with any advice we provide will guarantee compliance with any legal or regulatory requirements. Our statements or opinions do not convey legal interpretation and government authorities or legal counsel should be contacted for such a response.

Aqueous Hybrid Ion Rechargeable Battery SDS

SF-FM-00021_B

Rev Date: 8/5/2014

Aquion Energy Inc. Aqueous Hybrid Ion Rechargeable Battery

The batteries referenced herein are exempt articles and are not subject to the OSHA Hazard Communication Standard requirement. This sheet is provided as a service to our customers and presumes normal conditions of use of the batteries.

Safety Data Sheets (SDS) are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an "article".

OSHA has defined "article" as a manufactured item other than a fluid or particle; (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g. minute or trace amounts of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Because all of our batteries are defined as "articles", they are exempt from the requirements of the Hazard Communication Standard; hence an SDS is not required.

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	Aqueous Hybrid Ion Rechargeable Battery
SYNONYMS	Not known
RELEVANT USE	Electrical
CHEMICAL FAMILY	Mixture
MANUFACTURER	Aquion Energy, Inc.
ADDRESS	32 39 th Street Pittsburgh, PA 15206
EMERGENCY PHONE	1-412-904-6400

SECTION 2: HAZARDS IDENTIFICATION

GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELING (GHS)	
OSHA HAZARDS	Irritant
TARGET ORGANS	Respiratory System and the Cardiovascular System
SIGNAL WORDS	Warning
PICTOGRAMS	
GHS CLASSIFICATION	Not Classified
GHS LABEL ELEMENTS	Exclamation Mark
HAZARD STATEMENTS	H316 Causes Mild Skin Irritation



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PRECAUTIONARY STATEMENTS

HANDLING	
P261	Avoid breathing dust
P280	Wear protective gloves/protective clothing/eye protection
RESPONSE	
P304+340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES; Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.
P332+313	If skin irritation occurs: Get medical advice/attention
STORAGE	
P402	Store in a dry place
P404	Store in a closed container

CHRONIC HEALTH HAZARDS	
None known	
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE	
None known	
CARCINOGENICITY	
OSHA	Not known
ACGIH	Not known
NTP	Not known
IARC	Not known

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT	COMMON NAME	CAS NUMBER	% WT
Water	Water	7532-18-5	30-35
Sodium Sulfate	Sodium Sulfate	7757-82-6	2-5
Activated Carbon	Activated Carbon	7440-44-0	5-8
Sodium Lithium Dititanium Triphosphate	N/A	N/A	20-25
Lithium Manganese Dioxide	LMO	39457-42-6	25-30
Graphite	Graphite	7782-42-5	2-7
Polypropylene	Polypropylene	9003-07-0	Not applicable
PTFE	PTFE	9002-84-0	0.5-2
Acrylic	Acrylic	Mixture	0.5-2
Stainless Steel	Stainless Steel	N/A	8-10

SECTION 4: FIRST AID MEASURES

EYES
Contact with the contents of an opened battery can cause irritation. If eye contact with contents of an open cell occurs, immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes while holding the eyelids open. If irritation persists, transport the victim to an emergency care facility. If necessary, continue flushing during transport to emergency care facility.
SKIN
Contact with the contents of an opened battery may cause irritation. If skin contact with contents of an open cell occurs, as quickly as possible remove contaminated clothing, shoes and leather goods. Immediately flush



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with lukewarm, gently flowing water for at least 30 minutes. If irritation persists, seek medical attention.
INGESTION
Give one or two glasses of water to drink to any victim who may have ingested battery materials. Seek medical attention if gastrointestinal symptoms develop. If ingestion of a large amount does occur, call a poison control center immediately. Refer to oral ingestion limits based on LD50 values given below for individual chemical components.
INHALATION
Exposure to combustion products can be harmful. In case of adverse exposure to vapors or combustion products, remove the affected victim from exposure. Provide artificial respiration if necessary and seek medical attention. Inhalation of dust generated from an opened/damaged battery can result in irritation in the throat. Move to fresh air and get medical attention if discomfort continues.
GENERAL
Contaminated clothing should be removed.

SECTION 5: FIRE-FIGHTING MEASURES

FLAMMABLE LIMITS IN AIR, (% BY VOLUME)	
UPPER	Not known
LOWER	Not known
FLASH POINT	
Not applicable	
AUTOIGNITION TEMPERATURE	
Fahrenheit	Not known
Celsius	Not known
NFPA HAZARD CLASSIFICATION	
HEALTH	1
FLAMMABILITY	0
REACTIVITY	0
OTHER	Not known

GENERAL HAZARD
The battery case may melt when heated above 120°C. The electrode materials may ignite in the event the battery case ruptures. Combustion products include carbon monoxide and carbon dioxide. The case itself may burn above 250°C and toxic fumes may be generated as the case burns.
EXTINGUISHING MEDIA
Water or other suitable extinguishing may be used to put out a fire.
SPECIAL FIRE FIGHTING PROCEDURES
If possible, remove the battery from firefighting area. If heated above 120°C, battery case may melt exposing flammable electrode materials to the fire. However, there is no risk of explosion. Use NIOSH/MSHA approved full-face self-contained breathing apparatus (SCBA) with full protective gear.
UNUSUAL FIRE AND EXPLOSION HAZARDS
Not known to be combustible but if dust is airborne keep a safe distance from dust cloud if ignition is possible. When burned, hazardous products of combustion including carbon oxides can occur.
HAZARDOUS DECOMPOSITION PRODUCTS
Not known



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SECTION 6: ACCIDENTAL RELEASE MEASURES

ACCIDENTAL RELEASE MEASURES
Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
ON LAND
Use a vacuum equipped with a HEPA filter and place in containers to properly dispose. Avoid raising dust. Avoid inhalation of dust and contact with skin and eyes. Collect the spilled material in containers and prevent them from contaminating water.
IN WATER
If possible, remove from water and call local fire/police department.
CONTAINMENT/CLEANUP
Not known

SECTION 7: HANDLING AND STORAGE

HANDLING
No special protective clothing required for handling individual battery modules. Do not expose operating temperatures to below 0°C or above 60 °C.
STORAGE
Store in a cool, dry place.
OTHER PRECAUTIONS
Not known

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS
Airborne exposures to hazardous substances are not expected when product is used for its intended purpose. Keep away from heat and open flame. Store in a cool, dry place.
VENTILATION
Use in well-ventilated area.
RESPIRATORY PROTECTION
Not required during normal operations. SCBA required in the event of a fire.
EYE PROTECTION
Not required beyond safety practices of employer.
SKIN PROTECTION
Not required for handling of cells.
FOOT PROTECTION
Steel-toed shoes recommended for large container handling.
OTHER PROTECTIVE CLOTHING OR EQUIPMENT
Have a safety shower and eye-wash fountain readily available in the immediate work area.
WORK HYGIENE PRACTICES
Wash all exposed areas with soap and water.

CONCENTRATION	PPM	mg/m3
OSHA PEL-TWA	Not known	Not known
OSHA PEL STEL	Not known	Not known
OSHA PEL CEILING	Not known	Not known
ACGIH TLV-TWA	Not known	Not known
ACGIH TLV STEL	Not known	Not known
ACGIH TLV CEILING	Not known	Not known



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SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Solid Object
ODOR	No characteristic odor
ODOR THRESHOLD	Not applicable
pH	7
PHYSICAL STATE	Solid
MELTING/FREEZING POINT	Not known
BOILING POINT	Not known
FLASH POINT	Not known
EVAPORATION RATE	Not known
FLAMMABILITY (solid/gas)	Not known
UPPER/LOWER FLAMMABILITY/EXPLOSIVE LIMITS	Not known
VAPOR PRESSURE	Not known
VAPOR DENSITY	Not known
DENSITY	Not known
SOLUBILITY IN WATER	Insoluble
AUTO-IGNITION TEMPERATURE	Not known
DECOMPOSITION TEMPERATURE	Not known
VISCOSITY	Not known
MOLECULAR WEIGHT	Not known

SECTION 10: STABILITY AND REACTIVITY

REACTIVITY	Not known
CHEMICAL STABILITY	Stable at standard temperature and pressure.
POSSIBILITY OF HAZARDOUS REACTIONS	Not known
CONDITIONS TO AVOID (STABILITY)	Avoid exposing the cell to fire or temperatures above 80°C. Do not disassemble, crush, short or install with incorrect polarity. Avoid mechanical or electrical abuse.
HAZARDOUS DECOMPOSITION OR BY-PRODUCTS	No hazardous decomposition materials are generated during normal operating conditions. This material may release toxic fumes if burned or exposed to fire.
HAZARDOUS POLYMERIZATION	Will not occur
CONDITIONS TO AVOID (POLYMERIZATION)	Avoid exposure to heat and open flame. Do not puncture, crush or incinerate.

SECTION 11: TOXICOLOGICAL INFORMATION

ROUTES OF EXPOSURE	
SKIN CONTACT	The chemicals in this battery are contained in a sealed container. Under normal conditions of use, no known risk of exposure exists via inhalation, ingestion, skin and eyes. Risk of exposure occurs only if the cell is thermally or electrically abused to the point of compromising the
EYE CONTACT	
INHALATION	



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INGESTION	enclosure and/or initiating a fire. If this occurs, exposure to the combustion products may happen by inhalation of the vapors.
SYMPTOMS (PHYSICAL, CHEMICAL, AND TOXICOLOGICAL CHARACTERISTICS)	
Not known	
EFFECTS (DELAYED/IMMEDIATE & CHRONIC EFFECTS OF SHORT/LONG TERM EXPOSURE)	
None known	
NUMERICAL MEASURES OF TOCIXITY	
CHEMICAL NAME	LETHAL DOSE (LD50, oral, rat) mg/kg
Sodium Sulfate	5989
Activated Carbon	10000
Sodium Lithium Ditungsten Triphosphate	Unknown
Manganese Dioxide	3478
Polypropylene	2000-10000
Lithium Carbonate	525
Graphite	2500

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICITY
Under normal conditions, these materials are contained and pose no known risk to persons or the surrounding environment. The product is not classified as environmentally hazardous. The degradability of the product has not been stated. No data available on bioaccumulation. The batteries are not intended to be released into water or on land but should be disposed or recycled according to local regulations.
PERSISTENCE AND DEGRADABILITY
The degradability of this material has not been stated.
BIOACCUMULATIVE POTENTIAL
Not known
MOBILITY IN THE SOIL
Not known
OTHER ADVERSE EFFECTS
Not known

SECTION 13: DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD
Do not dump into any sewers, on the ground or into any body of water. Store material for disposal as indicated in Section 8 - Handling and Storage. Dispose of this material and its container to hazardous or special waste collection point. Do not allow this material to drain into sewers/water supplies. Dispose of according to all federal, state, and local regulations.
RCRA HAZARD CLASS
Not listed

SECTION 14: TRANSPORT INFORMATION

In general, all batteries in all forms of transportation (ground, air, or ocean) must be packaged in a safe and responsible manner. Regulatory concerns from all agencies for safe packaging require that batteries be packaged in a manner that prevents short circuits and be contained in "strong outer packaging" that prevents spillage of contents.
UN NUMBER AND SHIPPING NAME



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Not known
TRANSPORT HAZARD CLASS(ES)
Not known
U.S. DEPARTMENT OF TRANSPORTATION
The sodium ion battery is not regulated by the DOT as a dangerous good. The individual constituents in the battery are not regulated by DOT.
WATER TRANSPORTATION
Not known
AIR TRANSPORTATION
Not known
OTHER AGENCIES
None

SECTION 15: REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS
<i>OSHA Hazard Communication Standard, 29 CFR 1910.1200</i> Manganese compounds are listed as hazardous materials. However, in an enclosed battery under normal conditions of use, no known risk of exposure exists.
<i>TSCA Section 8b – Inventory Status</i> All chemicals comprising this product are either exempt or listed on the TSCA Inventory.
<i>TSCA Section 12b – Export Notification</i> If the finished product contains chemicals subject to TSCA Section 12b export notification, they are listed below: Lithium Manganese Oxide (CAS# 12057-17-9) -- 1.0 % One-Time Export Notification only
<i>SARA/TITLE 3 III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)</i> As an article, this battery and its contents are not subject to the requirements of the Emergency Planning and Community Right-To-Know Act.
STATE REGULATIONS
None known
INTERNATIONAL REGULATIONS
None known
OTHER AGENCIES
None known

SECTION 16: OTHER INFORMATION

DISCLAIMER: As the conditions of use of the product described herein are beyond our control, Aquion Energy Inc. neither assumes nor authorizes any person to assume for it any liability in connection with the use of the product. The information provided herein is given in good faith, but Aquion Energy Inc. MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. In no event shall Aquion Energy Inc. be liable for any special, incidental, or consequential damages resulting from the use of the product or in reliance upon information herein.