

# **Energy Pipeline Industry Pipe Quality Action Plan**

**PHMSA  
Advisory Committees  
Washington, D.C.**

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# Pipe Quality Summit – Purpose of June 11 Meeting

- Construction issues are real and although not wide spread, are being treated as if they were
- There are a wide range of issues
- Today, we are focused on pipe quality
- We need to work together to clearly understand the “pipe quality” issues
- Develop possible solutions for the issues
- Define action plans
- Make assignments with deliverables
- Leave the meeting with a common vision
- Keep PHMSA informed of our actions
  - Follow-up June 18 in D.C.
  - We should be able to answer questions from their letter

# Industry Foundation Pipe Quality Summit

- INGAA Foundation Sponsored – June 11
- 120 Participants – all aspects of supply chain
  - Natural gas operators - 40
  - Hazardous liquid operators - 15
  - Pipe/steel manufacturers & coaters - 25
  - Constructors – 3
  - Standards Organizations – 5
  - Consultants/TPI/Other - 20
- Background Presentations
- Point-by-point review of input provided by PHMSA
- Open discussion of issues
- Eight breakout groups covering four topics
- Developed input for 10 Point Action Plan

# Pipe Quality Summit - Key Messages

- Conveyed/acknowledged that issues are real. We are working to define:
  - How widespread?
  - How deep is it in the supply chain?
  - Impact on safety and integrity?
- Many aspects are working and we want to build off those with multifaceted solutions for areas of improvement
- API/ASME standards serve as the foundation to build upon. Operators must have a quality management system in place.
- Industry is mobilized and has developed a plan.
- Will be open/inclusive to deal with issues – looking for collaboration to restore confidence in pipe.
- We will implement the advisory in a uniform, consistent manner.
- Similar challenge as experienced in early stages of integrity management development.

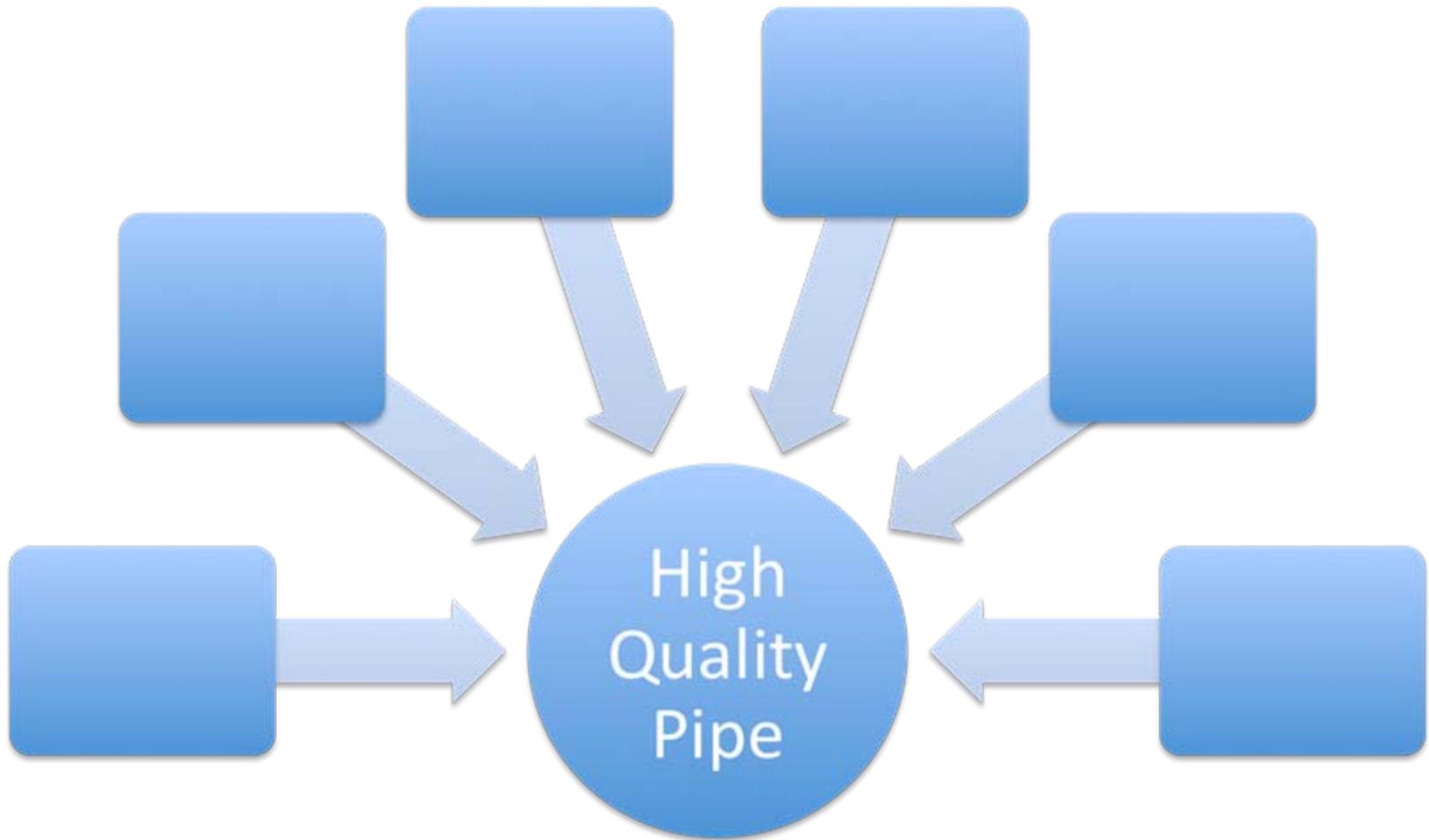
# Energy Pipeline Industry

## Pipe Quality Action Plan

1. Identification of Low and Variable Yield High Strength, Low Alloy Steel
2. Line Pipe Quality Management
3. Evaluation of Enhancements to API 5L
4. Evaluation of Enhancements to Operator Specifications and Practices
5. Evaluation of Enhancements to Pipe Manufacturer Specifications and Practices
6. Understanding Steel Stress Strain Behavior and Pipe Expansion
7. Development of Methods to Understand Implications of Expansions on Stress and Strain and Implications to Each Threat in ASME B31.8S
8. Evaluate Implications of Expansions On Coatings

Note: Original action plan items 6 and 7, and 8 and 9 were combined because of the interrelationship between tasks and the experts to be drawn upon.

# Integrated Multifaceted Approach To Improving Quality



# **Work Group 1 - Implementation of Advisory Bulletin – Identification of Low and Variable Yield Strength in High Strength, Low Alloy Steel**

**Scope:** Develop a uniform process for responding to the PHMSA Advisory Bulletin, PHMSA-2009-0148.

## **Action Plan:**

1. Industry representatives will meet to develop uniform approach(es) to responding to advisory
  - Tailor approach to design factor
  - Other factors such as history with source materials
2. Will share and adjust approaches developed through interaction with PHMSA
3. Recommend considering “expected variability” in lieu of “no variability in pipe properties” in applying advisory with operators

**Executive Champion:** Jeryl Mohn    **Technical Champion:** Dave Johnson

# Work Group 2 – Line Pipe Quality Management

**Scope:** Develop a comprehensive quality management system for line pipe building upon API 5L, Annex B

## **Action Plan:**

1. Bring issues to API Subcommittee 20 on Supply Chain Management
2. Approach SC 20 to further develop Annex B of API 5L, 44<sup>th</sup> Edition
3. Life Cycle JIP to develop white paper providing critical technical elements and background
4. INGAA and API Issue (Pipeline Operators) Policy Statement that encourages use of Annex B on projects to be operated under 0.8 design factor
5. Encourage API Monogram Program to consider audits of steel suppliers.

**Executive Champion:** Dan Martin    **Technical Champion:** Jesus Soto

**API Committee Champion:** Alex Afaganis, Evraz, Line Pipe Vice Chair

## Work Group 2 – Line Pipe Quality Management - Status

- After consultation, API Subcommittee 20 on Supply Chain Management was not the appropriate place for codifying quality management systems
- Solution is to ensure that steelmakers, steel processors and pipe manufacturers use quality management systems
- **Work Group 2** modified to provide oversight by Pipe Quality Leadership Team
- API Monogram Program enhancing anonymous reporting and monitor performance of manufacturers
- <http://www.api.org/Newsroom/new-quality-website.cfm>

# Work Group 3 - Evaluation of Enhancements to API 5L

**Scope:** Evaluate enhancements to API 5L reflecting on changes in new edition, 44<sup>th</sup> edition, with emphasis on traceability, testing and retest provisions.

## **Action Plan:**

1. Bring issues to API Line Pipe Committee
  - Initial discussion in June 2009 meeting
2. Review traceability, testing and retest provisions and verification of non-conformance practices
3. Encourage involvement of PHMSA personnel in Line Pipe Committee
4. Propose that tensile test results should approximate a predicted elastic modulus; atypical values should require retest.

**Executive Champion:** Jeryl Mohn    **Technical Champion:** Larry Christmas

**API Committee Champion:** Alex Afaganis, Evraz, Line Pipe Committee Vice Chair

## **Work Group 3 - Evaluation of Enhancements to API 5L - Status**

- Revisions to API 5L drafted in work group
- To be balloted at January 2010 meeting in New Orleans
- Designate hot rolling as a process requiring validation considering tensile variability
- Clarify testing and retesting protocols
- Expand MPS/ITP requirements including protocols for non-conforming product and traceability
- It is critical that Foundation members who have personnel serving on API 5L that they are involved in revisions
- It is critical that Foundation members that procure pipe encourage mills to be involved in revisions

# Work Group 4 - Evaluation of Enhancements to Operator Specifications and Practices

**Scope:** Review processes for incorporating pipe spec provisions into pipe manufacturing processes and recommend leading practices and enhancements that operators can incorporate.

## **Action Plan:**

1. Strengthen API 5L, Annex B to incorporate process for integrating operator pipe spec provisions into MPSs and ITPs, for steel producers, steel suppliers and pipe manufacturers.
2. Conduct Workshop on Best Practices for Operator QMS, including essential pre-production activities
3. Life Cycle JIP White Paper to propose process for API Line Pipe Committee to consider.
4. Evaluate enhancements to traceability, testing, retesting and verification of non-conformance practices in operator specs

**Executive Champion:** Andy Drake **Technical Champion:** Steve Rapp

## **Work Group 4 - Evaluation of Enhancements to Operator Specifications and Practices - Status**

- Best practices were shared at INGAA Foundation Pipe Quality Summit – June 2009
- Best Practices Workshop – 1Q 2010
- White Paper on Procurement and Inspection Best Practices – 1Q 2010
- Ensure quality and consistency by augmenting API standards
- Expect more scrutiny if extensive retesting occurs in the mill

# Work Group 5 - Evaluation of Enhancements to Pipe Manufacturer Specifications and Practices

**Scope:** Review processes for incorporating pipe spec provisions into pipe manufacturing processes and recommend leading practices and enhancements that manufacturers can incorporate.

## **Action Plan:**

1. Strengthen API 5L, Annex B to incorporate process for integrating operator pipe spec provisions into MPSs and ITPs, for steel producers, steel suppliers and pipe manufacturers.
2. Develop capability to provide real-time information, histograms, etc.
3. Define key process check points that do not compromise proprietary aspects of production.
4. Conduct Workshop on Best Practices for Pipe Manufacturer QMS.
5. Evaluate enhancements to traceability, testing, retesting and verification of non-conformance practices

**Executive Champion:** Rob Turner, Stupp **Technical Champion:** Alex Afaganis, Evraz

## **Work Group 5 - Evaluation of Enhancements to Pipe Manufacturer Specifications and Practices - Status**

- Work group reviewing practices to anticipate changes in API 5L
- Coordinating with Work Group 4 to anticipate response to best practices
- Evaluating enhancements to traceability, testing, retesting and verification of non-conformance practices – may involve use of technology
- Best practices on quality management system
- White paper on key elements of quality management system

# Work Group 6 - Understanding Steel Stress Strain Behavior and Pipe Expansion

**Scope:** Develop methods to understand stress strain behavior in high strength, low alloy steels and the expansion of pipe in mill and field hydrostatic tests.

## **Action Plan:**

1. Document applicability of finite element analyses to model formation of localized expansions.
2. Define modeling basis and validate with base case of non-expanded pipe as well as known expanded pipes and burst tests to correlate pipe mechanical properties, test pressure and percent expansion.
3. Approach ASTM to develop standardized method for flattened strap specimens.
4. Provide reference information about magnitude of uncertainty in MTR data.
5. Evaluate enhancements to PV plot to recognize significant yielding (ASME B31.8, Appendix N, consider German Standard).
6. Develop common basis for calculating expansion and incorporate into API 1163 (Overarching ILI RP)
7. Apply variability in MTR values into model to project onset of pipe yielding. Develop basis for differentiating low yield pipe.
8. Evaluate value of additional R&D to develop parametric study to validate modeling.

**Executive Champion:** Andy Drake **Technical Champion:** Steve Rapp

# Work Group 6 - Understanding Steel Stress Strain Behavior and Pipe Expansion - Status

- Clarified the relationship between mill and field hydrostatic tests – “effective combined stress”
- Developed a generalized stress-strain model
- Validated by burst tests from several operators
- Model developed is slightly more conservative than published ASME model
- Working on developing standards methods
  - Tensile test (flattening straps)
  - Interpretation of deformation tool data
- Developed draft of expected variability of pipe properties from plate, coil and pipe
- Anticipate Webinar in 1Q 2010

# Work Group 7 - Development of Methods to Understand Implications of Stress and Strain on Expansions and Implications to Each Threat in ASME B31.8S

**Scope:** Develop a basis for managing pipe with reduced strain capacity, especially for 0.8 design factor systems and evaluate each threat and impact of expansions on integrity. Defects that are a result of strain are of concern; mechanical damage, as well as weather and outside force. Address by grade as margin between Y and T decreases.

## **Action Plan:**

1. Define how much reduction in yield to tensile is allowable and how the Y/T relates to total strain.
2. Evaluate current strain limits in B31.8, i.e.- 2% total strain and suitability as a threshold.
3. Evaluate suitability of higher levels of strain with additional O&M provisions.
4. Evaluate each threat and define impact.
5. Demonstrate that each threat was evaluated below a threshold level.
6. Above threshold, develop more conservative O&M practices.
7. Consider interactive threats; especially those resulting from strain.

**Executive Champion:** Dave Chittick **Technical Champion:** Mark Hereth

# Work Group 7 - Development of Methods to Understand Implications of Stress and Strain on Expansions and Implications to Each Threat - Status

- Developed a decision tree – process flow for managing expanded pipes – establishes stage gates/multiple criteria
- Reviewed applicable standards for strain throughout the world
- ASME B31.8, Section 833.5, explicitly addresses strain for stress beyond yield
- Establishes a limit of 2% strain limit subject to .....
  - Consideration of ductility, weldability, fracture control, threat analysis
- Primary effect of strain on integrity is outside loads – strain carrying capacity
- White paper drafted and under review
- To be a part anticipated Webinar in 1Q 2010

# Work Group 8 - Evaluate Implications of Expansions On Coatings

**Scope:** Evaluate the degree to which expansions compromise coating and ultimately lead to cracking and disbonding. Consider coating type (non-shielding vs. shielding, ARO), nature of expansion (localized or extended), among others.

## **Action Plan:**

1. Evaluate work conducted by PRCI and historical experience with bending tests.
2. Evaluate data from expanded pipes.
3. Develop test protocol and conduct tests. Initial work by manufacturers and coating applicators. May require PRCI/PHMSA research.
4. Establish guidance thresholds by coating type, and other factors to be determined.

**Executive Champion:** Jesus Soto    **Technical Champion:** Neil Hruzek

# Work Group 8 - Evaluate Implications of Expansions On Coatings - Status

- Developed white paper on research related to expansion and impacts on FBE coatings
- Operators provided results from tensile tests on FBE coated pipe
- Developed a test matrix for additional tests on FBE coated pipe
  - Tensile tests (1, 2, 3%, to cracking)
  - Production tests to confirm performance
- Developed relationship between bend tests and FBE adhesive properties
- Preliminary work indicates that coatings are not the limiting factor
- Crazeing at 6% and cracking at 6 to 10%

# Pipe Expansions - In Context

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- A pressure test verifies that a pipeline can operate at a pressure significantly above the operating pressure (safety factor) by not leaking or failing during the test
- Pipe expansion is a rare event caused by the yielding of low strength steel material that occurs during a pressure test used to verify the safety factor of the pipeline
- Yielding of pipeline material, per se, does not threaten the integrity of the pipeline
- We have a group of experts defining an acceptable level of expansion for pipeline integrity purposes
- This is one among other possible threats we manage in a pipeline integrity program with defined criteria
- **Pipe expansion as a result of a successful pressure test does not pose an immediate threat to the safety or integrity of the pipeline.**

# Integrated Multifaceted Approach To Improving Quality



# Conclusions

- Continuing to explicitly involve stakeholders – Commitment to “have everyone at the table”
- The rigor of 0.8 DF project requirements identified these issues
- Not just responding to single issues, but developing integrated approach
- Raising the bar, clarifying diligence and improving quality and consistency

