

THE INGAA FOUNDATION, INC.

# **Expanding the Reliable Natural Gas Transmission System with Enhanced Quality Practices**

**API Annual Pipeline Conference**

**April 21, 2010**

**Daniel B. Martin**

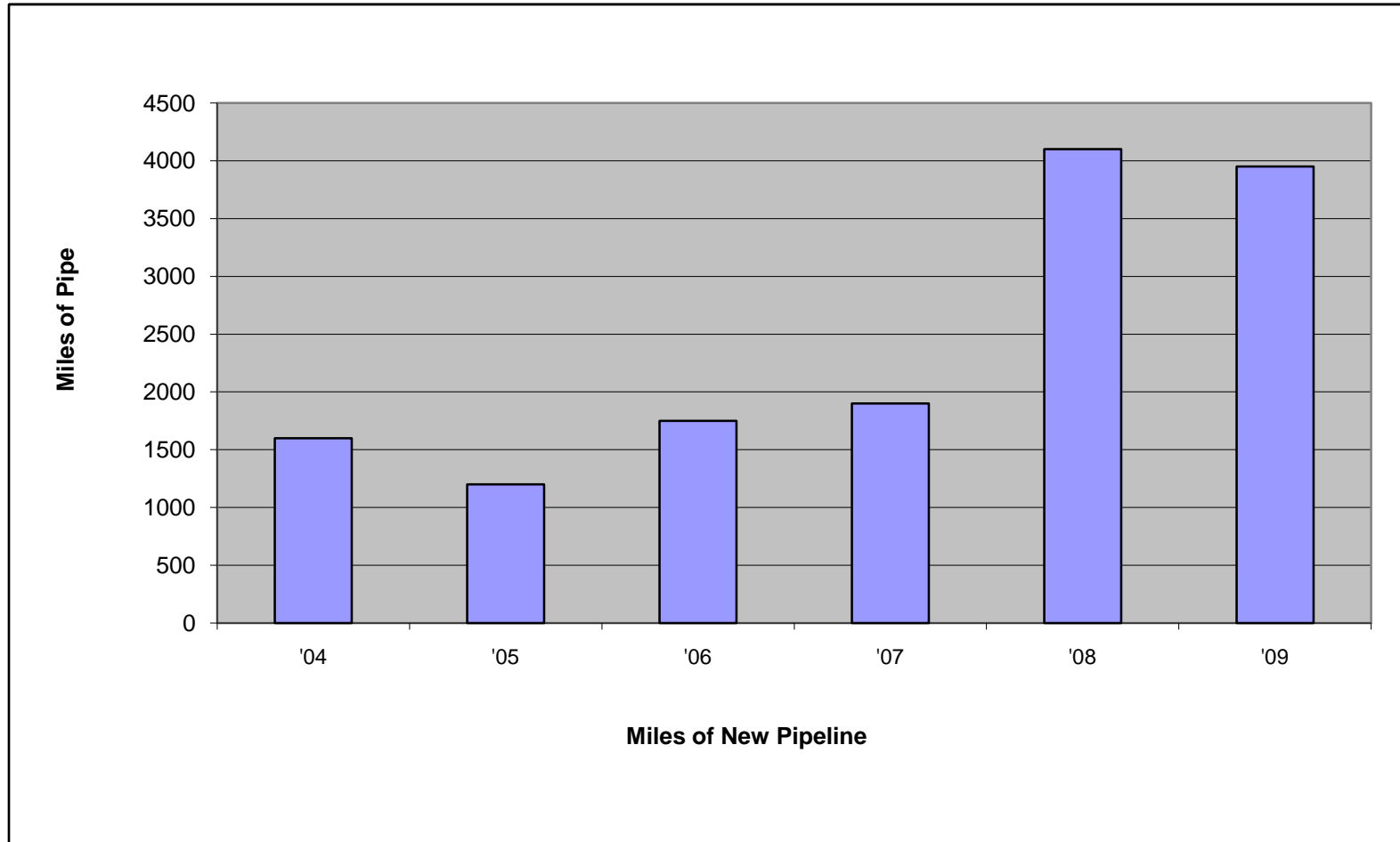
**Vice Chairman, INGAA Foundation**

# Agenda

- Background
- Actions Undertaken
- Current Status



# Miles of Pipeline Since 2004: Issues Began To Become Apparent



# PHMSA Observations

## Regarding Increased Construction Activity

- What went wrong?
  - Low and variable strength “yield” pipe
  - Pipe chemical composition
  - Bevels on end of pipe
  - Welding issues
  - Segmenting of hot bends and offset weldability
  - Pipe coating
  - Construction staffing knowledge issues
- What went right?
  - Parallel construction
  - Finding low yield pipe
  - Mitigating welding issues
  - Corrosion surveys finding coating damage
- Industry reaction was that these are isolated issues that need further understanding



# Recent History of Related Meetings and Notices

June 2008	<b>INGAA Foundation</b> Workshops: Bevels & Construction Quality Assurance/Control
March 2009	<b>INGAA Foundation</b> Workshop on Building Better Pipelines
April 2009	PHMSA Construction Workshop on New Pipeline Construction
May 2009	PHMSA Advisory Bulletin – Potential Low and Variable Yield and Tensile Strength and Chemical Composition Properties in High Strength Line Pipe
June 2009	<b>INGAA Foundation</b> Pipe Quality Summit
October 2009	<b>INGAA Foundation</b> Construction Quality Summit



# PHMSA Advisory May 21, 2009

- Low and Variable Yield and Tensile Strength and Chemical Properties
- Pertains to Grade X-70 and higher strength pipe
- Recent construction
- Need to Investigate
  - Review manufacturing procedure specifications and test results (steel and coil)
  - Review pipe specifications and technical documentation review (pipe production test results, hydrostatic test results)
  - Based on knowledge and findings, consider using deformation tool to detect expansion



# PHMSA Challenge to Trade Associations

- How can industry and PHMSA **credibly define** the precise nature and **extent of problems** identified during the recent new pipeline construction projects?
- **Which** underlying **standards or regulations need to be** examined or **changed** to help improve pipeline fabrication and construction quality control?
- What **other ideas to improve** overall fabrication and construction **quality control** does the industry believe warrant additional attention?
- For example, does your association and membership see value in developing a more **comprehensive quality management system standard** to make these improvements? If so, which system elements would you see as needed?
- At a **minimum**, which **testing and quality control requirements** do you believe need to be incorporated into all new pipeline construction projects to ensure their fitness for purpose prior to commissioning?
- Lastly though process and technology improvements may be needed, we also welcome your ideas on how we can both ensure that **workers** employed in these fast- paced and challenging construction projects are **fully trained and qualified** to carry out their duties competently?



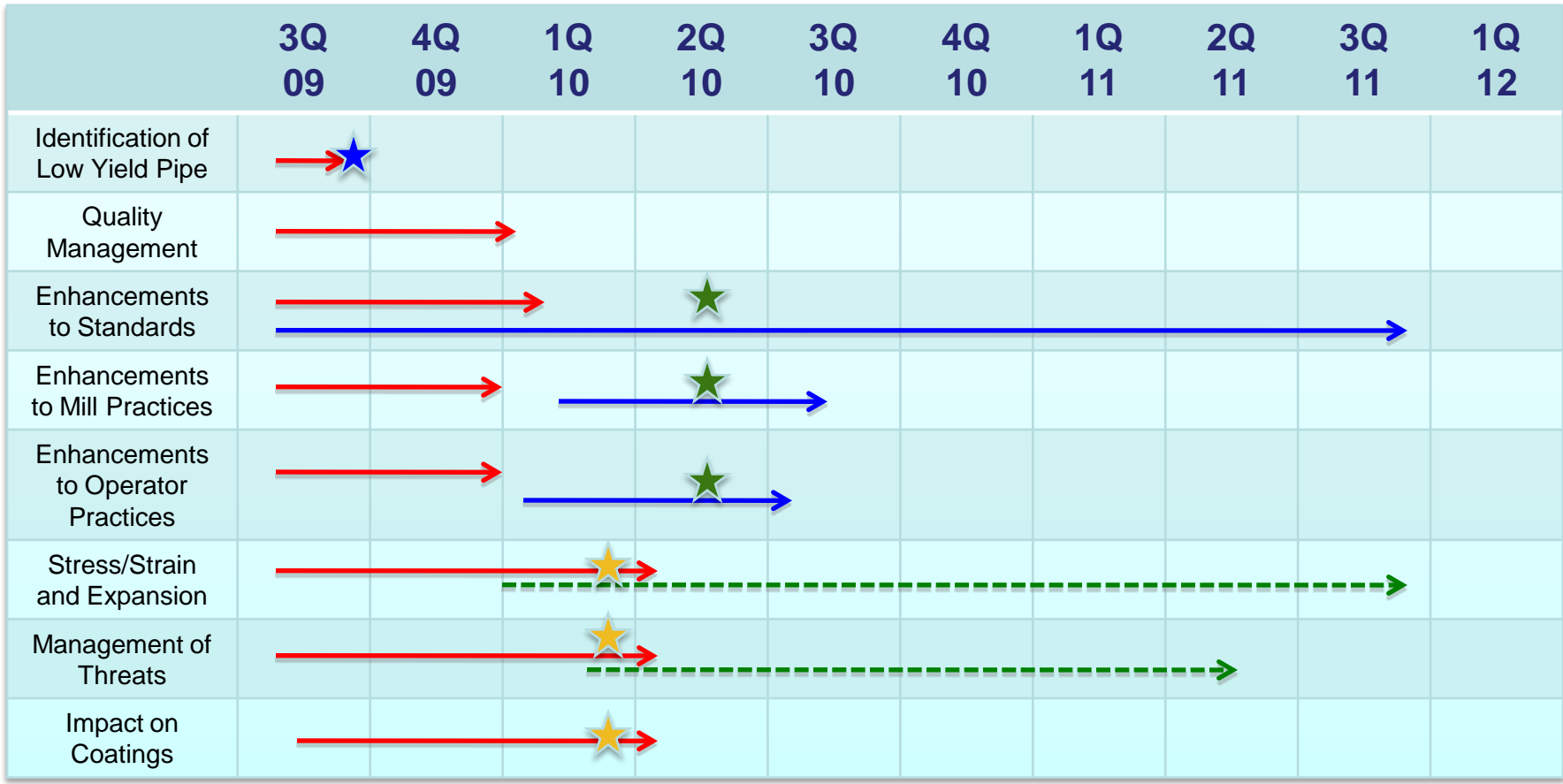
# Energy Pipelines

## Pipe Quality Action Plan

1. Identification of Low and Variable Yield Strengths in High Strength Low Alloy Line Pipe Steel
2. Line Pipe Quality Management
3. Evaluation of Enhancements to American Petroleum Institute (API) Pipe Standards
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 Pipe Coatings



# Timeline for Pipe Quality Action Plans



**Quick-Hit White Papers** →

**Longer-Term Work Efforts Culminating in Standards** →

**Research** - - - →



# Pipeline Construction: Quality Issues and Solutions Action Plans

1. Best Practice on implementing API 1104 Appendix A
2. Resolution of API 5L and 1104 NDE issues
3. Best practices for Field Applied Coatings
4. Quality Management System for Pipeline Construction
5. Training Guidance (KISS) for Construction Workforce & Inspectors – Welding and Coating
6. Develop technical guidance for segmenting hot bends and offset weldability



# Pipeline Construction Group Scope

- Group 1
  - Enhance the utilization of API 1104 Appendix A by developing clear guidelines and understandable best practices for operators and contractors.
- Group 2
  - Identify and resolve the issues between API 5L and 1104 (e.g. dimensional tolerances, mechanical properties, multiple suppliers to a single project) that impact the quality of construction.
- Group 3
  - Best practices for the selection and the proper application of field applied coatings will be defined.



# Pipeline Construction Group Scope

- Group 4
  - A QMS framework for new pipeline construction will be defined and published in a white paper.
- Group 5
  - Construction workers and inspectors need simple but effective training tools to interpret and apply specifications and procedures for field coating and welding. Sample training guidance will be proposed.
- Group 6
  - Develop technical guidance for segmenting hot bends and offset weldability



# Others Are Watching To See If Industry Can Correct The Problems

- PHMSA – Regulatory Option – Construction “Op-Qual”
- Financial Analysts – October 2009 INGAA Foundation Stakeholder Meeting
  - Periodic mention in reports
  - Questions during analyst calls
- Shareholders



# Summary

- Pipeline Industry Credibility is on the line
- Individual Stakeholders/Everyone in INGAA Foundation needs to support the effort
  - Operators – Procurement, Construction, Inspection
  - Steel/Pipe/Coating Suppliers – Quality Products
  - Construction Firms
  - Services/Support Companies
  - Standards Organizations



# Questions?



# Appendix

- Pipe Quality Action Plan Status
- Pipeline Construction Action Plan Status



# 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



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

**Status:** White Paper developed and distributed in September 2009,  
Supported by PHMSA





# 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 to 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 09 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
- 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 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 in June 2009
- Workshop on Procurement and Inspection Best Practices to be scheduled in 2010
- White Paper on Procurement and Inspection Best Practices will be drafted following workshop
- Additional scrutiny from DOT should be expected if there is extensive retesting to qualify pipe in the mill or pipe-quality related concerns arise during construction
- Working with API and manufacturers to facilitate implementation and consistent application



# 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 Groups 6 & 7- 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 for niobium/vanadium, low microalloy X-70 steels
- Validated by burst tests from several operators
- Model developed is slightly more conservative than that published by ASME
- Working to define improvements standard for tensile testing
- Developed white paper defining basis to evaluate/interpret deformation tool data based on manufacturing requirements, testing & performance – white paper routing for final comments
- Work groups 6 and 7 have been combined – products are integrated into a common decision tree
- Original scope of Task 6 and 7 is effectively complete. PRCI will conduct a critical review of this work and prepare a Gap Analysis to identify any need for additional work



# 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 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 FBA 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 tensile and bend tests
- Preliminary work indicates that coatings are not the limiting factor
- Crazeing at 6% and cracking at 6 to 10%



# Pipeline Construction: Quality Issues and Solutions Action Plans

1. Best Practice on implementing API 1104 Appendix A
2. Resolution of API 5L and 1104 NDE issues
3. Best practices for Field Applied Coating
4. Quality Management System for Pipeline Construction
5. Training Guidance (KISS) for Construction Workforce & Inspectors – Welding and Coating
6. Develop technical guidance for segmenting hot bends and offset weldability.



# Work Group 1 – Best Practices in Implementing API 1104 Annex A

**Scope:** Enhance the utilization of API 1104 Appendix A by developing clear guidelines and understandable best practices for operators and contractors that provide a common, technically sound approach to the identification of essential variables, development of required data and application of the analytical methods.

## **Action Plan:**

1. Provide common, technically sound approach to the identification of essential variables
2. Development of required data
3. Application of the analytical methods

**Executive Champion:** Dick Keyser – NiSource

**Technical Champion:** Brian Laing – CRC Evans



# Work Group 1 – Best Practices in Implementing API 1104 Annex A (cont)

**Status:** Work Group formed and work scope developed

## **Key Deliverables:**

1. Survey operators' experience in applying Appendix A – Q2-2010
2. Identification of essential variables and boundaries – Q3-2010
3. Draft Best Practices – Q4 2010
4. Final Best Practices – Q1 2011



# Work Group 2 – Resolution of API 5L & API 1104 NDE Issues

**Scope:** Identify the issues that have the potential to impact successful projects and develop a plan to resolve the issues.

## **Action Plan:**

1. Formalize membership in the API ad hoc Joint Liaison Work Group
2. Define issues to be addressed from previous workshops and other forums
3. Define action plans to address each issue

**Leadership Champion:** Larry Christmas – Panhandle (INGAA Foundation liaison)

**Technical Champion:** API Standards Joint Liaison group formed from 5L and 1104 committees



# Work Group 2 – Resolution of API 5L & API 1104 NDE Issues (cont.)

## **Status:**

- API 5L and 1104 formed (API/1104 Joint Liaison) work group composed of 6-Manufacturers, 3 – Operators, 3 – Eng. Consulting, 2 – Construction Contractors, 1- Vendor and 1 – Regulator, in late February 2010.
- First joint meeting has been schedule for Tuesday, June 29<sup>th</sup> 2010 during the API E&P Summer Standards Conference in Washington, D.C.

**Deliverables:** Revised standards or clarifications to existing standards



# Work Group 3 – Best Practices for Field Applied Coating

**Scope:** The proper application of field applied coatings is an essential element to the long-term integrity of a pipeline. Document common-sense best practices in the form of a white paper for use by Operators and Contractors

## **Action Plan:**

1. Identify the numerous products and procedures currently used by industry
2. Develop a white paper of Best Practices
3. Evaluate other types of field applied coatings (tape, wax, etc.)

**Leadership Champion:** Craig Linn – Williams

**Technical Champion:** Dave McQuilling - Panhandle

**Status:** Work Group formed and work scope developed

## **Key Deliverables:**

1. Development of White Paper of Best Practices – Q4 2010
2. Evaluate other types of field applied coating - 2011



# Work Group 4 – Quality Management Systems (QMS) for Pipeline Construction

**Scope:** QMS has been employed in many different forms between Operators and Projects. This work group will provide best practices guidance for implementing QMS in a pipeline construction project

## **Action Plan:**

1. Establish a charter
2. Evaluate various practices being used or available
3. Develop a white paper outlining a framework for construction

**Leadership Champion:** Mark Yeomans – TransCanada

**Technical Champion:** Ronnie Wise – Price Gregory & Mike Lane – Universal Pegasus

**Status:** Work group formed, first face-to-face meeting planned end of April.

## **Key Deliverables:**

1. Develop a QMS white paper outlining a framework for construction – Q4 2010



# Work Group 5 – Training Guidance (KISS) for Construction Workers & Inspectors – Welding and Coating

**Scope:** Develop simple but effective training guidance for construction management and workers to enable solid construction practices

## **Action Plan:**

1. Analyze generally available specifications and procedures
2. Translate the detailed documents (“contract language”) into brief, simply stated requirements
3. Develop training guidance (KISS) document

**Leadership Champion:** Paul Amato – Iroquois

**Technical Champion:** Craig Meier – Sunland Construction



# Work Group 5 – Training Guidance (KISS) for Construction Workers & Inspectors – Welding and Coating (cont)

**Status:** Work Group formed and work scope under development

**Key Deliverables:**

1. Key elements of effective training packages – Q2 2010
2. Example of typical package for coating and welding – Q4 2010
3. Workshop on implementing key elements Q1 2011



# Work Group 6 – Welding of Field Segmented Induction Bends and Elbows for Pipeline Construction

**Scope:** Develop guidance for the use of field segmented induction bends and elbows for pipeline construction

**Action Plan:**

1. Develop guidance regarding specification and purchase of segmentable induction bends and elbows.
2. Develop guidance for field construction practices including preparation of the bend or elbow, proper fit-up measurements and tolerances, welding including backwelding, and NDT.

**Leadership Champion:** Andy Drake – Spectra

**Technical Champion:** A Joint Industry Project conducted by DNV and P-PIC that is funded by six gas transmission companies



# Work Group 6 – Welding of Field Segmented Induction Bends and Elbows for Pipeline Construction (cont)

**Status:** The JIP is formed and work has commenced

**Key Deliverables:**

1. The guidance described in Action Plans 1 and 2 will be completed and available by the end of 2010.



# Timeline for Pipeline Construction Action Plans

	3Q 09	4Q 09	1Q 10	2Q 10	3Q 10	4Q 10	1Q 11	2Q 11	3Q 11	4Q 11	
Best Practice Implementing API 1104		→									
Resolution of API 5L and 1104 issues				- - - - - →			→				
Best Practices for Field Applied Coating		→									
Quality Management System for P/L Construction		→									
Training Guidance (KISS) for Construction Workforce & Inspectors – Welding & Coating							→				
Guidelines for segmented Induction bends		→									

Quick-Hit White Papers



Longer-Term Work Efforts Culminating in Standards



Research

