Technologies Supporting Higher Stress Level Operation

David Johnson
Background - 1

• Traditionally, pipeline operation in U.S. limited to 72% of SMYS
  – Typical mill test to 90% SMYS
  – Operate at 80% of test

• Provided lots of margin for tolerances in
  – Dimensions
  – Properties
  – Processes
Background - 2

• Why increase to 80%?
  – Consistent with other codes
  – Several “grandfathered” lines there now
  – Operating pressure / stress level - Not a primary driver for risk

• Manage active integrity threats
  – Materials  – Excavation
  – Construction  – Outside force
  – Corrosion  – Equipment
  – Operations
Background - 3

• Increased utilization of existing infrastructure (300k miles)
  – Public impacts
  – Construction impacts
  – Environmental impacts
  – Land utilization
  – Resource utilization

• Where to look?
  • Over 50 years of R&D
Key Areas

• Pipe Design
  – Fracture Control Plan
  – Carbon Equivalents
• Coatings
• Weld Inspection
• Pressure Testing
• ILI & DA
• Threat Assessments
• Repairs
Technology Development

• Pipe fracture control plan
  – Defect tolerance – stable, leak, rupture
  – Dynamic behavior – propagate/arrest

• Carbon equivalents & hardness
  – Hardenability
  – Cracking potential
Technology Development

• Pipe coatings
  – Application & testing
  – Effectiveness

• Weld inspection
  – X-ray & UT
  – Defect limits
  – Workmanship vs. ECA Criteria
Technology Development

• Pressure testing
  – Technical understanding
  – Engineered tests

• Corrosion Control
  – ILI
  – DA – EC & IC
  – CP
Technology Development

• Threat Assessments – Identify & Manage
  – Materials
  – Construction
  – Corrosion
  – Operations

• Repairs (Pipeline Repair Manuals)
  – Materials
  – Techniques
Technology Publications (too numerous to list)

- PRCI
  
  http://www.prci.org/publications

- GTI
  
  http://www.gastechnology.org

- PHMSA
  
  http://primis.phmsa.dot.gov/rd
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<th>Project Code</th>
<th>Project Title</th>
<th>Team Leader</th>
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<td>PR-186-9706</td>
<td>Effects of Pressure Fluctuations on Near-Neutral SCC Propagation</td>
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<td>PR-186-9709</td>
<td>Integrity and Remaining Life of Line Pipe with Stress Corrosion Cracking</td>
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<td>PR-187-821</td>
<td>Pulsed Gas Metal Arc Welding of API 5LX-80 Pipe</td>
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<td>Energy Based Pipe-Soil Interaction Models</td>
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<td>Development of Ultrasonic Vehicle for the Detection of Stress Corrosion Checking in Buried Gas Pipelines</td>
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<td>PR-198-9108</td>
<td>Development of Inspection Vehicle to Detect SCC in Natural Gas Lines</td>
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<td>Fatigue Strength of Seamless Line Pipe and Modern ERW Line Pipe</td>
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<td>PR-202-009</td>
<td>Fracture Behavior of Girth Welds Containing Natural Defects, Comparison with Existing Workmanship Standards</td>
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<td>PR-202-219</td>
<td>Effect of Defect Size and Yield to Tensile Ratio on Plastic Deformation Capacity Pipeline Stress</td>
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<td>Fracture Behavior of Large Diameter Pipeline Girth Welds: Effect of Weld Metal Yield Strength - Part I [Team Leader - unavailable]</td>
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<td>Fracture Behavior of Large-Diameter Pipeline Girth Welds: Effect of Weld Metal Yield Strength and Defect Interaction, Part II [Team Leader - unavailable]</td>
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<td>PR-202-922</td>
<td>Effect of Weld Metal Yield Strength and Defect Interaction on Pipeline Performance, Volume II [Team Leader - unavailable]</td>
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<td>PR-202-922</td>
<td>Effect of Weld Metal Matching on Girth Weld Performance Vol. I [Team Leader - unavailable]</td>
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<td>PR-202-9326</td>
<td>Weld Metal Yield Strength Testing of Girth Welds [Team Leader - unavailable]</td>
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<td>Effect of Defect Size and YS/TS Ratio on the Plastic Deformation Capacity of X70 and X80 Pipe Steels [Team Leader - unavailable]</td>
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<td>Alternative Acceptance Criteria of Girth Weld Defects [Team Leader - unavailable]</td>
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<td>Interaction of Multiple Through-Thickness Defects Under Plastic Collapse Conditions (Part I) [Team Leader - Horsley]</td>
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<td>Effects of Welding on HAZ Softening of X70 / X80 TMCP Linepipe Steels [Team Leader - Horsley]</td>
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<td>PR-202-9732</td>
<td>The Effect of Weld Metal Yield Strength Matching &amp; Defect on Pipeline Reliability and Structural Integrity of Girth Welds in X70 Pipe [Team Leader - Horsley]</td>
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<td>PR-206-013</td>
<td>Welding on Fluid Filled Pressurized Pipelines: Transient 3D Analysis of Temperature, Microstructure, Stress, and Strain [Team Leader - Dorling]</td>
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<td>PR-214-9852</td>
<td>Altro ASPE 1002 Specifying Acceptance/Rejection Criteria To Avoid Repeat Weld Failures in API 370 Pressure Vessel Construction [Team Leader - Rothwell]</td>
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Watch this Space

As requests for higher pressure operation continue to be filed and considered, the requirements are evolving.

The requirements continue to be founded in collaboratively developed technology.