Technologies Supporting Higher Stress Level Operation

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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
  - Construction
  - Corrosion
  - Operations
  - Excavation
  - Outside force
  - Equipment

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
  - Excavation
  - Outside force
  - Equipment
- 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

Partial Project Listing – PRCI

(One representative page of 27 total)

PR-186-9706	Effects of Pressure Fluctuations on Near-Neutral SCC Propagation [Team Leader - Torgunrud]
PR-186-9709	Integrity and Remaining Life of Line Pipe with Stress Corrosion Cracking [Team Leader - unavailable]
PR-187-821	Pulsed Gas Metal Arc Welding of API 5LX-80 Pipe [Team Leader - unavailable]
PR-187-9212	Centerline Segregation in Plate and Strip for Linepipe Produced from Continuously Cast Slabs [Team Leader - unavailable]
PR-187-9602	Tensile Property Variation in DSAW and ERW Line Pipe [Team Leader - unavailable]
PR-194-719	Energy Based Pipe-Soil Interaction Models [Team Leader - unavailable]
PR-194-719	Pipe-Soil Interaction Tests on Sand and Soft Clay [Team Leader - unavailable]
PR-198-808	Development of an Ultrasonic Vehicle for the Detection of Stress Corrosion Cracking In Buried Gas Pipelines [Team Leader - unavailable]
PR-198-9108	Development of Inspection Vehicle to Detect SCC in Natural Gas Lines [Team Leader - unavailable]
PR-201-9707	Fatigue Strength of Seamless Line Pipe and Modern ERW Line Pipe [Team Leader - unavailable]
PR-202-009	Fracture Behavior of Girth Welds Containing Natural Defects, Comparison with Existing Workmanship Standards [Team Leader - unavailable]
PR-202-010	Effect of Defect Size and Yield to Tensile Ratio on Plastic Deformation Capacity Pipeline Steels [Team Leader - unavailable]

PR-202-011	Fracture Behavior of Large Diameter Pipeline Girth Welds: Effect of Weld Metal Yield Strength - Part 1 [Team Leader - unavailable]
PR-202-011	Fracture Behavior of Large-Diameter Pipeline Girth Welds: Effect of Weld Metal Yield Strength and Defect Interaction, Part II [Team Leader - unavailable]
PR-202-922	Effect of Weld Metal Matching on Girth Weld Performance, Volume II: Experimental Investigation [Team Leader - unavailable]
PR-202-922	Effect of Weld Metal Matching on Girth Weld Performance, Volume III: An Engineering Critical Assessment (ECA) Analysis [Team Leader - unavailable]
PR-202-922	Effect of Weld Metal Matching on Girth Weld Performance Vol. I [Team Leader - unavailable]
PR-202-9326	Weld Metal Yield Strength Testing of Girth Welds [Team Leader - unavailable]
PR-202-9327	Effect of Defect Size and YS/TS Ratio on the Plastic Deformation Capacity of X70 and X80 Pipe Steels [Team Leader - unavailable]
PR-202-9328	Alternative Acceptance Criteria of Girth Weld Defects. [Team Leader - unavailable]
PR-202-9514	Interaction of Multiple Through-Thickness Defects under Plastic Collapse Conditions (Part I) [Team Leader - Horsley]
PR-202-9514	Interaction of Multiple Surface Breaking Notches Under Plastic Collapse (Part II) [Team Leader - Horsley]
PR-202-9635	Effects of Welding on HAZ Softening of X70 / X80 TMCP Linepipe Steels [Team Leader - Horsley]
PR-202-9732	The Effect of Weld Metal Yield Strength Mismatch & Yield-to-Tensile Ratio on the Structural Integrity of Girth Welds in API 5L X 80 Pipe [Team Leader - Horsley]
PR-206-013	Welding on Fluid Filled Pressurized Pipelines: Transient 3D Analysis of Temperature, Microstructure, Stress, and Strain [Team Leader - Dorling]
PR-214-9802	Interim Approach to Determine Crack Arrest Toughness to Avoid Dynamic Ductile Fracture in Gas Transmission Pipelines [Team Leader - Rothwell]

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.