Pipeline Research Council International, Inc.

PHMSA Presentation

Expanding In-Line Inspection Capabilities & Application

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PHMSA Research & Development Meeting
September 11-12, 2018

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Mission Statement

To collaboratively deliver relevant and innovative applied research to continually improve the global energy pipeline systems.

PRCI Membership

- **32 Energy Pipeline Operating Companies**
  - 17 Natural Gas Transmission; 7 Liquid
  - 8 Liquid/Natural Gas
- **4 Pipeline Industry Organization (PIO) Members**
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  - Association of Oil Pipe Lines (AOPL)
  - Canadian Energy Pipeline Association (CEPA)
  - Operations Technology Development (OTD)
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  - Australia, Canada, China, Europe, Japan, U.S.
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  - 45 North American Companies (U.S. & Canada)
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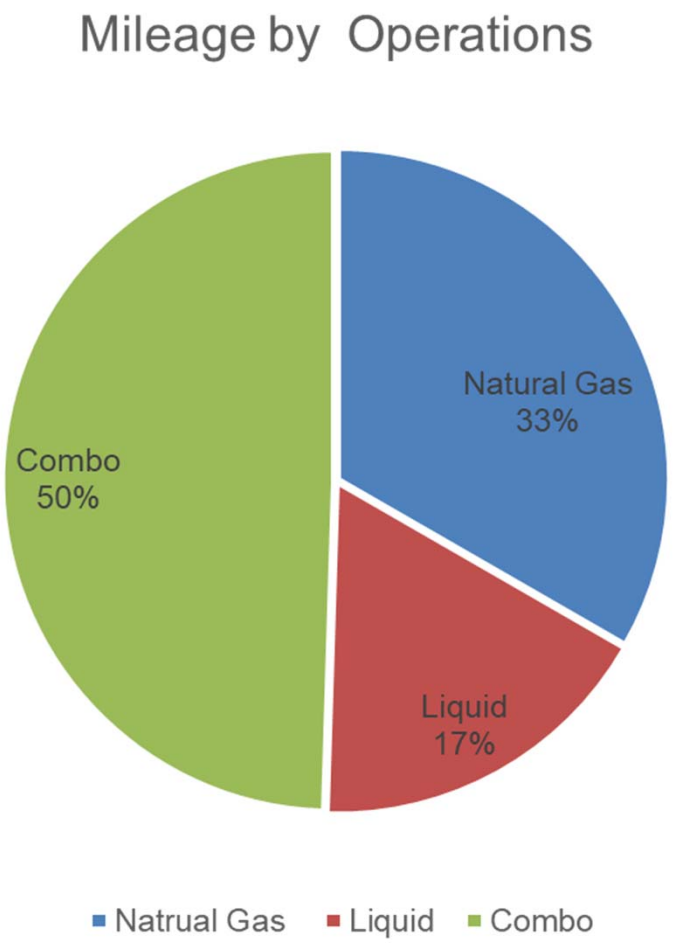
- Alliance
- ATCO
- Boardwalk
- Cadent
- Dominion
- Energy Transfer
- Gassco
- Gasunie
- GRTgaz
- National Fuel
- National Grid
- OTD
- PG&E
- SoCalGas
- Total
- TransGas
- Williams

Liquid

- API
- AOPL
- Buckeye
- Chevron
- Colonial
- ExxonMobil
- FHR
- Marathon
- Phillips 66
- Plains

Combo

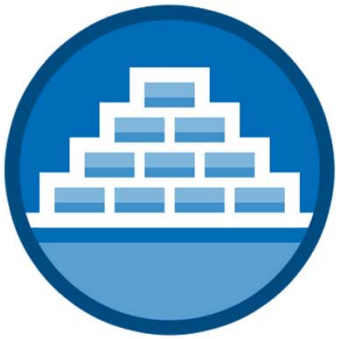
- ConocoPhillips
- Enbridge
- Enterprise
- Kinder Morgan
- Petrobras
- PetroChina
- Shell
- TransCanada



PRCI Research

PIPELINE TECHNICAL COMMITTEES

Corrosion



Design, Materials & Construction

Integrity & Inspection

Surveillance, Operations & Monitoring

PRCI Research

FACILITY TECHNICAL COMMITTEES

Compressor
& Pump Station

Measurement

Underground
Storage

Technology Development Center (TDC)

Presentation Overview

- Recent Completed Work
- Ongoing Work
- Areas of Further Interest

Recent Completed Work

- **Creation of a pipeline industry test facility and Technology Development Center.**
- **Verifiable, Traceable, Complete Records**
  - Using ILI to determine pipe material properties and discrepancies.
  - Evaluating the performance of a portable hardness, strength, and ductility (HSD) tester.
  - Evaluation of multiple in-ditch techniques to validate material properties characterization.
- **Girth Welds**
  - In-line inspection and assessment for pipeline girth welds.

Ongoing Work

- **Dents, Cracks in Dents**
  - Direct comparisons of ILI, NDE, X-ray CT, and metallographic sectioning for crack-in-dent anomalies, with feedback to vendors.
- **Electric Resistance Weld Cracks**
  - Direct comparisons of ILI, NDE, X-ray CT, and metallographic sectioning for ERW seam anomalies, with feedback to vendors.
  - Qualification of NDE methods for in-ditch analysis of ERW anomalies
  - Creation of a database of ILI data, and subsequent evaluation of crack tool performance and indicators.
- **Stress Corrosion Cracks**
  - Direct comparisons of ILI, NDE, X-ray CT, and metallographic sectioning for SCC anomalies, with feedback to vendors.
  - SCC crack depth sizing performance comparison and validation using X-ray CT and metallographic sectioning for multiple UT techniques, and comparison to ILI data.

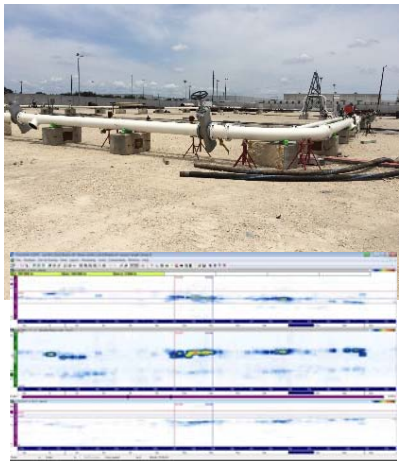
Ongoing Work

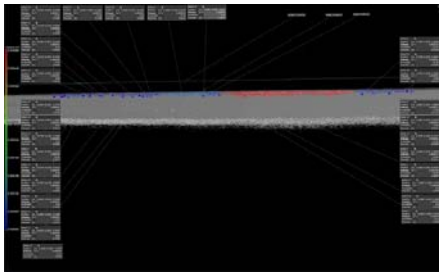
- **Difficult to Inspect**
  - Creation of a decision matrix for conversion or replacement of DTI lines, using high resolution NDE as a decision aid.
  - Fundamental studies of the science behind large standoff magnetometry (LSM)

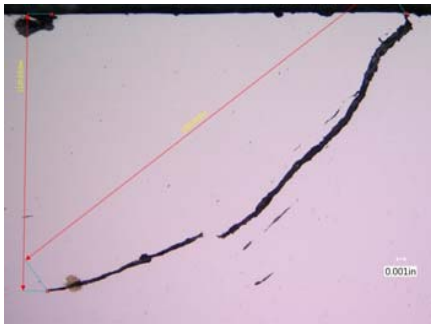
- **Other**
  - Pinhole ILI tool evaluation.
  - Investigating the effects of manufacturing processes on pipe material quality.
  - The role of human factors in NDE evaluation.

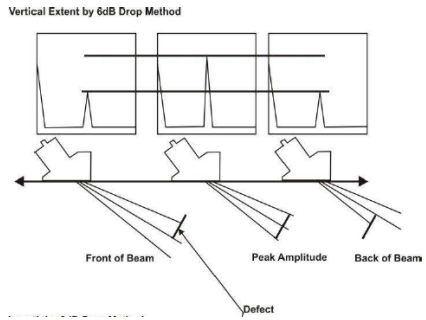
Ongoing Work - Expanding In-Line Inspection Capabilities & Application

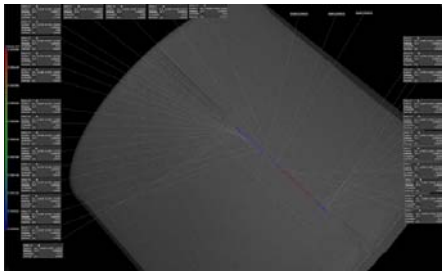
- **Thorough analyses**
  - ILI, NDE, X-ray, metallographic sectioning
- **Feedback loop to ILI vendors**
- **Multiple threats being investigated with this process**
  - ERW, cracks in dents and gouges, SCC











ILI → NDE → X-Ray CT → Sectioning

Ongoing Work – Use of Flow Loop and Pull String Facilities

Areas of Further Interest

- **Multiple areas of interest**
  - Improved and novel NDE, NDE for difficult to inspect lines.
  - Clearer and more informed ILI test specifications (test spools, standardized terminology, and aggregated data support this).
  - Standard terminology, definitions, and classifications (mechanical damage and cracking).
  - LSM: Underlying science, and anomaly detection thresholds.
  - Test spools: Methodology trials using various techniques. Verification of test spools (NDE, X-ray CT, etc.).