



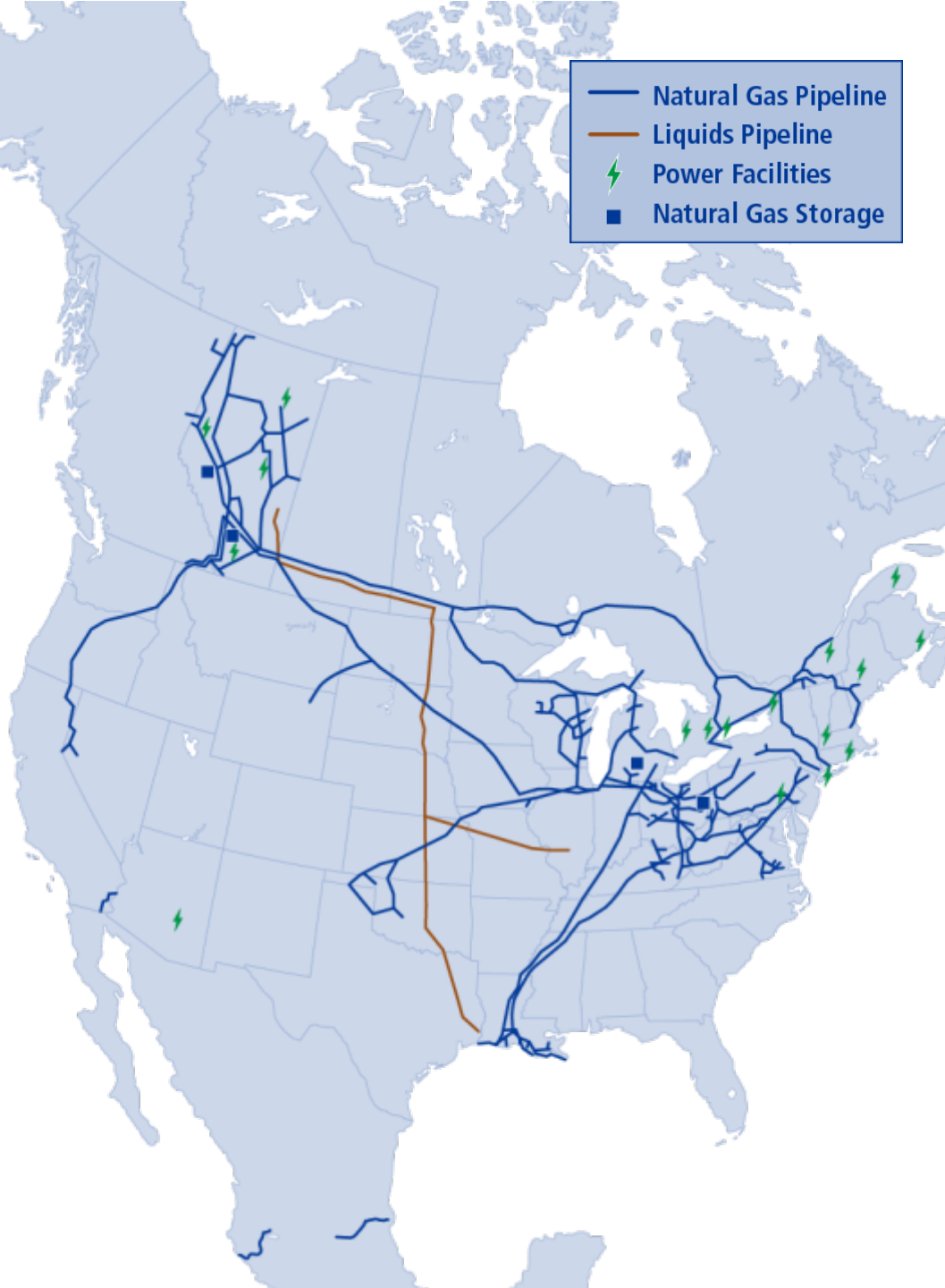
PHMSA R&D Forum

Gaps and Challenges Facing Pipeline Operators

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Asset Map



One of North America's Largest Natural Gas Pipeline Networks

- Operating 90,300 kms (56,100 miles) of pipelines
- Transports more than 25 per cent of continental demand

Cross-border Liquids Pipeline System

- Keystone Pipeline System: 4,300 km (2,700 miles), 545,000 bbl/d contracted capacity
- Safely delivered more than 1.3 billion barrels of Canadian oil to U.S. markets since 2010

North America's Largest Natural Gas Storage Operator

- More than 664 Bcf of capacity

Canada's Largest Private Sector Power Generator

- 17 power facilities, 10,500 MW
- Diversified portfolio, including wind, hydro, nuclear, solar and natural gas

INGAA: Guiding Principles of Pipeline Safety



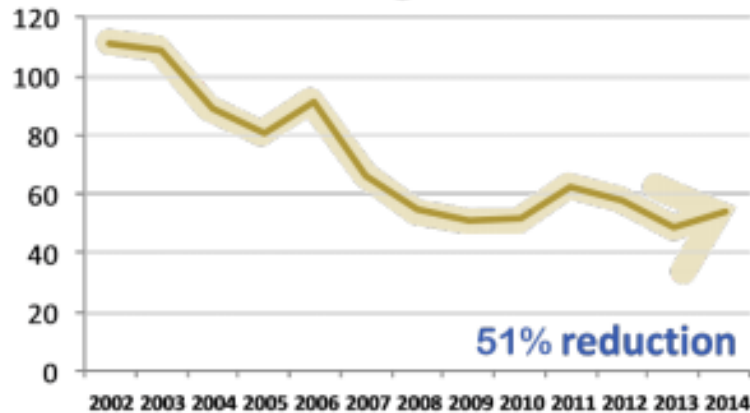
- **Our goal is zero incidents** - a perfect record of safety and reliability for the national pipeline system. *We will work every day toward this goal.*
- **We are committed to safety culture** as a critical dimension to continuously improve our industry's performance.
- **We will be relentless in our pursuit of improving** by learning from the past and anticipating the future.
- **We are committed to applying integrity management principles on a system-wide basis.**
- **We will engage our stakeholders** - from the local community to the national level - so they understand and can participate in reducing risk.



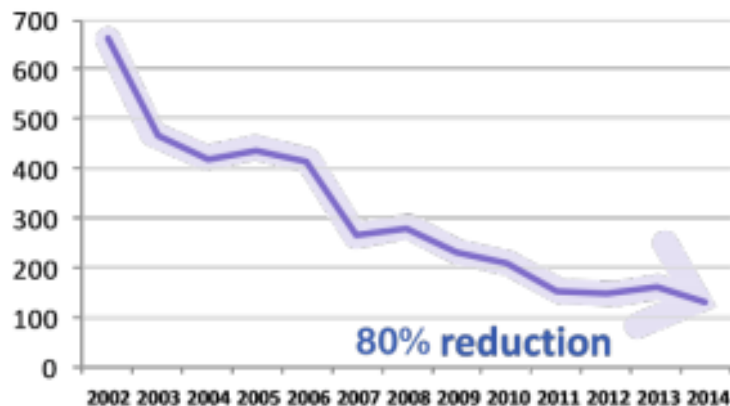
Industry Safety Performance Is Improving



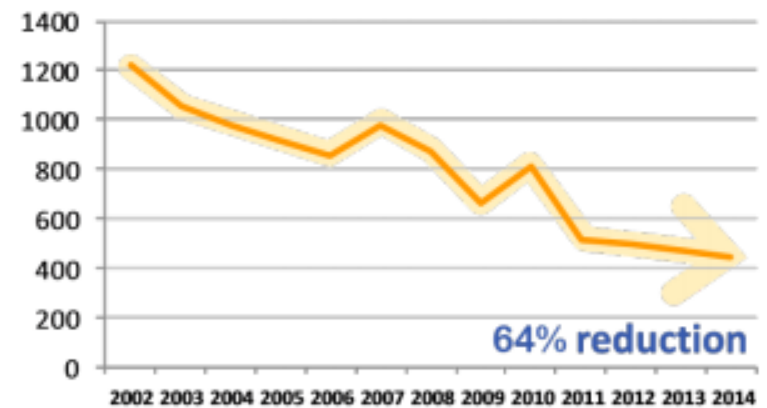
Excavation Damage Leaks



Material & Weld Leaks



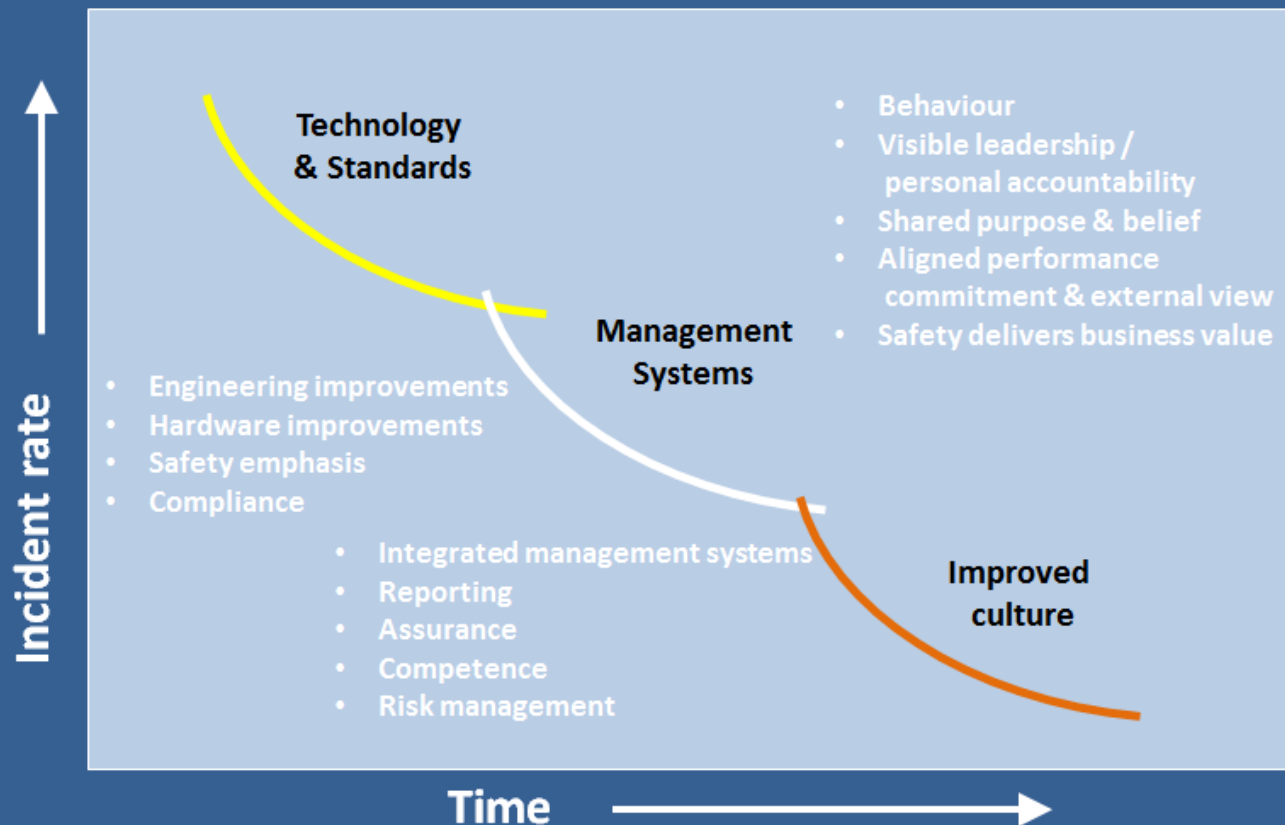
Corrosion Leaks



Improving Safety Performance – closing the gap



Safety Performance – Plateau Effect





Working Group 3 - Anomaly Detection/Characterization

- Gap #1 – Non-destructive methods for Determining Material properties – ILI & in ditch (WG5)
- Gap #2 – Improve ILI technology for coincident and challenging features – girth welds, dents with cracking and corrosion, seams.
- Gap #3 – Improve NDE performance/reliability through reducing human effects on NDE measurement systems. (WG5)
- Gap #4 – Develop/Enhance Inspection Technology for small diameter (2"-8") and Difficult to Inspect pipelines.
- Gap #5 – Pressure Test Design Guidelines – reliability, spike tests, destructive/damage, integration of inspection data, etc.



Working Group 5 Legacy Materials Challenges

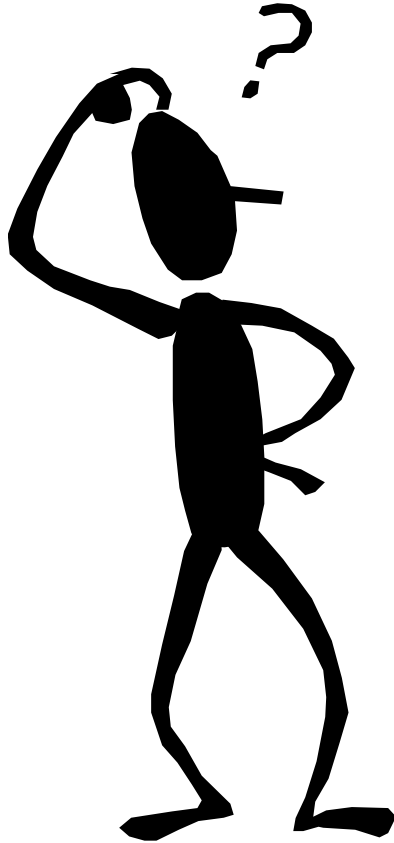
- Gap #1 – Develop inspection tools to quantify strength and toughness to improve integrity management process (Technology)
- Gap #2 – Develop operational guidelines/standards for usage (taking into account limitations) of ILI and pressure testing: based upon MAOP/MOP and an operating safety factor, for defect types, dimensions, inspection parameters, material properties, anomaly dimensions, failure modes, fatigue models, validation (unity plot), and re-assessment intervals, etc. (Consensus Standard)
- Gap #3 – In-the-ditch tools – qualification standards and training for NDE including strength & defect specific training and seam type (Consensus Standard / General Knowledge)

Technology Opportunities



- Engineering Critical Assessment process MAOP reverification
 - Long Seam management
- Crack Management
- In-the-ditch NDE for planar features
- Determination of material properties
- Trenchless renewal (MAOP reverification)
- NPRM
 - Spike HT, CP Systems, Dent management, Selective Seam Corrosion
- Challenge conservatism
- New approach to ILI
- ILI of tomorrow
- Data management
- Engineering Critical Assessment for MAOP reverification

Questions?



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