



In-line Inspection: An Integral Part of Pipeline Integrity Management

Presented by:
Bryce Brown
President, In-line Inspection Association (ILIA)

INGAA Pipeline Integrity Workshop
November 6, 2003
Las Vegas, NV.

Agenda



1. Introduction
2. Pre-Inspection
3. Applicability to Known Threats
4. Available Technologies
5. Summary

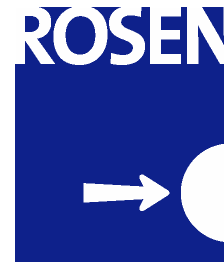
1. Introduction



ILI Association – founded April 2002



Pipeline Management Group



T.D. Williamson, Inc.

www.ILIAssociation.org

1. Introduction



- Support the Pipeline Industry in the need to enhance pipeline integrity.
- Raise the awareness of the ILI industry;
 - Overall Products & Services,
 - Current Technologies,
 - Capabilities & Limitations
 - Best Practices,
 - and R&D initiatives.
- Liaise with industry associations and regulatory bodies.
- Participate in the Consensus development of the structures that ensure provision of high quality ILI services.

1. Introduction



What is required of us?

- Our initiatives;
 - Overall, improve transparency,
 - Engage in the generation of Consensus Recommended Practices or Standards,
 - Continue to provide Next Generation technologies,
 - Provide New Solutions to meet the requirements of the industry,
 - Improve & Maintain Quality in a growth market.
- Meet Industry expectations
 - Pipeline Operator
 - Public



1. Introduction

- The New Regulations are anticipated to increase the demand for ILI products and services.
- Industry Recommended Practices are essential.
- Market demand issues;
 - Capital Equipment
 - Trained Personnel
 - Robust Systems
 - Quality Assurance
- Clarity and Commitment to the future are required to manage growth, i.e. to assess the adequacy of ILI resources available.

Agenda



1. Introduction
2. **Pre-Inspection**
3. Applicability to Known Threats
4. Available Technologies
5. Summary

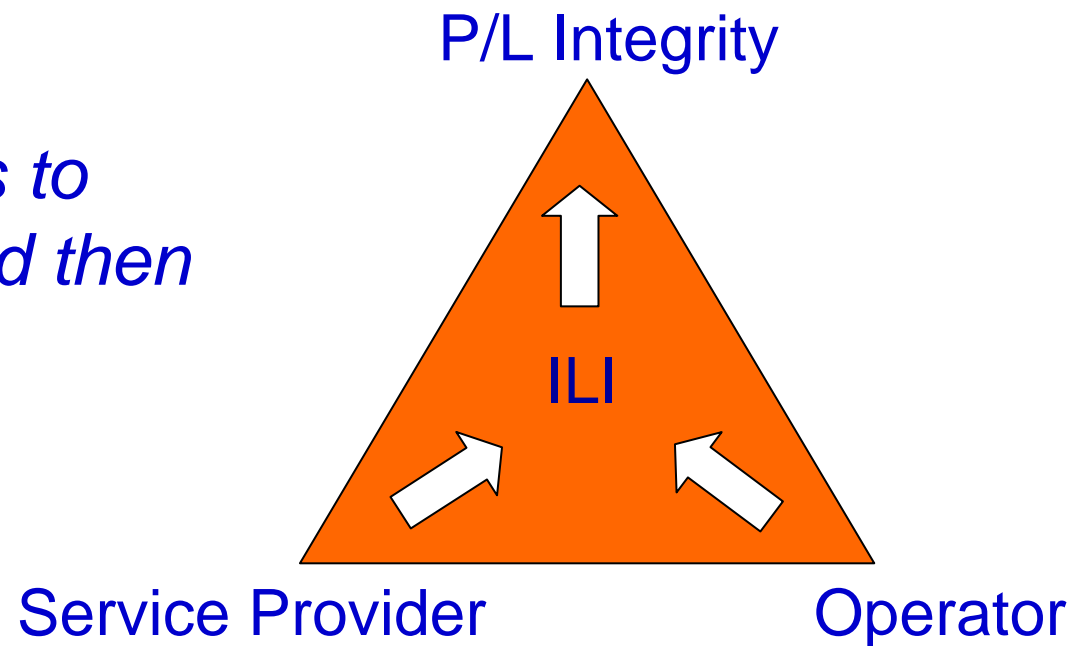
2. Pre-Inspection



Keys to a Successful In-line Inspection Program

- Effective Communication
- Clarity and Commitment

A Relationship has to be established, and then maintained.



2. Pre-Inspection



Keys to a Successful In-line Inspection Program

- Present information about inspection programs early.
- Plan projects over an extended period.
- What are the goals and objectives of the inspection?
- Understand the capabilities and limitations of the technologies available for the given goals and objectives.
- Collect and provide the necessary pipeline data in order to properly assess piggability, i.e. Technical Questionnaire.
 - Pipeline physical characteristics
 - Pipeline operational characteristics

The most important part of an ILI program.

2. Pre-Inspection



Available Guidance:

- “Specification and Requirements for Intelligent Pig Inspection of Pipelines”, version 2.1, November, 1998, European Pipeline Operator Forum
- NACE TR 35100, Item No. 24211
“In-Line Nondestructive Inspection of Pipelines” – 2001
- **NACE Standard RP0102-2002, Item No. 21094**
“Recommended Practice: In-Line Inspection of Pipelines” – 2002
- **API 1163, “ILI Systems Qualification” (2004)**
- **ASNT ILI-PQ-2003, “ILI Personnel Qualification” (2004)**

All initiated by the operator and fully supported by the service provider.

Agenda



1. Introduction
2. Pre-Inspection
- 3. Applicability to Known Threats**
4. Available Technologies
5. Summary

3. Applicability to Known Threats



a) Time Dependent

- 1) External Corrosion
- 2) Internal Corrosion
- 3) Stress Corrosion Cracking

b) Stable

- 4) Manufacturing Related Defects
 - Defective pipe seam
 - Defective pipe
- 5) Welding/Fabrication Related
 - Defective pipe girth weld
 - Defective fabrication weld
 - Wrinkle bend or buckle
 - Stripped threads/broken pipe/coupling failure
- 6) Equipment
 - Gasket O-ring failure
 - Control/Relief equipment malfunction
 - Seal/pump packing failure
 - Miscellaneous

c) Time Independent

- 7) Third Party/ Mechanical Damage
 - Damage inflicted by first, second, or third parties (instantaneous/immediate failure)
 - Previously damaged pipe (delayed failure mode)
 - Vandalism
- 8) Incorrect Operations
 - Incorrect operational procedure
- 9) Weather Related and Outside Force
 - Cold weather
 - Lightning
 - Heavy rains or floods
 - Earth Movements

**Reference:
ASME B31.8S**

3. Applicability to Known Threats



ILI PURPOSE	METAL-LOSS TOOLS			CRACK-DETECTION TOOLS		CALIPER TOOLS	MAPPING TOOLS
	Magnetic Flux Leakage (MFL)		Ultrasonic (compression wave)	Ultrasonic (shear wave)	Transverse MFL		
	Standard resolution (SR) MFL	High resolution (HR) MFL					
METAL LOSS (CORROSION) External corrosion Internal corrosion	detection ^(A) sizing ^(B) no ID/OD discrimination	detection, ^(A) sizing ^(B)	detection, ^(A) sizing ^(B)	detection, ^(A) sizing ^(B)	detection ^(A) sizing ^(B)	no detection	no detection
NARROW AXIAL EXTERNAL CORROSION	no detection ^(A)	no detection ^(A)	detection ^(A) and sizing ^(B)	detection, ^(A) sizing ^(B)	detection ^(A) sizing ^(B)	no detection	no detection
CRACKS AND CRACK-LIKE DEFECTS (Axial) Stress corrosion cracking Fatigue cracks Longitudinal seam weld imperfections Incomplete fusion (lack of fusion) Toe cracks	no detection	no detection	no detection	detection ^(A) sizing ^(B)	detection, ^{(A)(C)} sizing ^(B)	no detection	no detection
CIRCUMFERENTIAL CRACKING	no detection	detection ^(C) and sizing ^(C)	no detection	detection ^(A) and sizing ^(B) if modified ^(D)	no detection	no detection	no detection
DENTS SHARP DENTS WRINKLE BENDS BUCKLES	detection ^(E)	detection, ^(E) sizing not reliable	detection, ^(E) sizing not reliable	detection, ^(E) sizing not reliable	detection, ^(E) sizing not reliable	detection, ^(F) sizing	detection, sizing not reliable
GOUGES	In case of detection, circumferential position is provided. Detection ^(A) and Sizing ^(B)						
LAMINATION OR INCLUSION	limited detection	limited detection	detection and sizing ^(B)	detection and sizing ^(B)	limited detection	no detection	no detection
PREVIOUS REPAIRS	detection of steel sleeves and patches, others only with ferrous markers		detection only of steel sleeves and patches welded to pipe	detection only of steel sleeves and patches welded to pipe	detection only of steel sleeves and patches, others only with ferrous markers	-	-
	limited	limited					

Reference:

NACE Standard RP0102-2002

“Standard Recommended Practice In-line Inspection of Pipelines”

Agenda



1. Introduction
2. Pre-Inspection
3. Applicability to Known Threats
- 4. Available Technologies**
5. Summary

4. Available Technologies



- Multi-Channel (HR) Geometry (Caliper)
- High Resolution MFL
- High Resolution Circumferential MFL
- Ultrasonic: Metal Loss
- Ultrasonic: Crack Detection
- EMAT: Crack Detection
- Inertial Navigation
- Combination Technologies

Reference:

NACE International Publication 35100

“In-Line Nondestructive Inspection of Pipelines”

4. Available Technologies



Key Operational Improvements include:

- Speed Control
- Dual Diameter (typical 2 in., as high as 14 in.)
- 1.5D bend negotiation
- Longer inspection runs

Other developments or R&D efforts include:

- Un-Piggable Pipelines
 - Robotic Inspection Vehicles
- Tailor-made Solutions
- “Next Generation” Inspection Systems

4. Available Technologies



ILI Products and Services are a direct result of the Pipeline Industry's requirements and commitment.

What's next?

Agenda



1. Introduction
2. Pre-Inspection
3. Applicability to Known Threats
4. Available Technologies
5. **Summary**

5. Summary



- The New Regulations will increase the demand for ILI products and services.
- Clarity and Commitment to the future are required to manage growth.
- There are ILI tools and technologies available to address known threats.
- ILI resources, tools and personnel, will grow to meet the given demand.
- Continue to work together to understand the requirements of Pipeline Integrity Management and the application of ILI.



Thank you.

www.ILIAssociation.org