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

Presented by:  
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INGAA  
May 12, 2004  
The Woodlands, Texas

# Agenda

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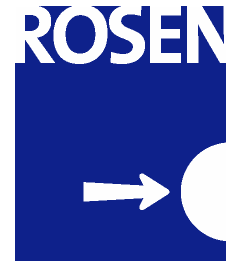
1. Introduction
2. Pre-Inspection
3. Applicability to Known Threats
4. ILI Technologies
5. New Developments
6. Summary

# 1. Introduction

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Pipeline Management Group



T.D. Williamson, Inc.

# 1. Introduction

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## What is required of us?

- Our initiatives;
  - 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, i.e. threats to integrity,
  - Improve & Maintain Quality in a growth market.
- Meet Industry expectations;
  - Pipeline Operator
  - Publicas a partner.

# Agenda

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## 2. Pre-Inspection

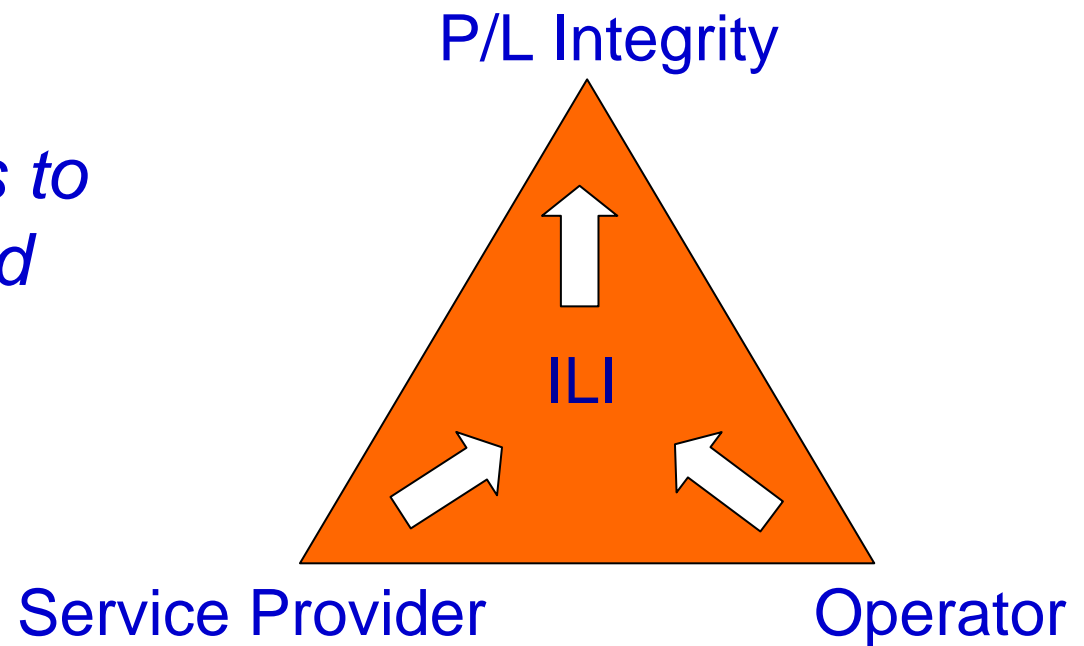
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### Keys to a Successful In-line Inspection Program

- Effective Communication
- Clarity and Commitment

*A Relationship has to be established, and maintained.*



## 2. Pre-Inspection

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### Keys to a Successful In-line Inspection Program

- Present information about inspection programs early.
- *Understand 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*

## 2. Pre-Inspection

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### 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.*

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# 3. Applicability to Known Threats

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## 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 <sup>(A)</sup> sizing <sup>(B)</sup> no ID/OD discrimination	detection, <sup>(A)</sup> sizing <sup>(B)</sup>	detection, <sup>(A)</sup> sizing <sup>(B)</sup>	detection, <sup>(A)</sup> sizing <sup>(B)</sup>	detection <sup>(A)</sup> sizing <sup>(B)</sup>	no detection	no detection
NARROW AXIAL EXTERNAL CORROSION	no detection <sup>(A)</sup>	no detection <sup>(A)</sup>	detection <sup>(A)</sup> and sizing <sup>(B)</sup>	detection, <sup>(A)</sup> sizing <sup>(B)</sup>	detection <sup>(A)</sup> sizing <sup>(B)</sup>	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 <sup>(A)</sup> sizing <sup>(B)</sup>	detection, <sup>(A)(C)</sup> sizing <sup>(B)</sup>	no detection	no detection
CIRCUMFERENTIAL CRACKING	no detection	detection <sup>(C)</sup> and sizing <sup>(C)</sup>	no detection	detection <sup>(A)</sup> and sizing <sup>(B)</sup> if modified <sup>(D)</sup>	no detection	no detection	no detection
DENTS SHARP DENTS WRINKLE BENDS BUCKLES	detection <sup>(E)</sup>	detection, <sup>(E)</sup> sizing not reliable	detection, <sup>(E)</sup> sizing not reliable	detection, <sup>(E)</sup> sizing not reliable	detection, <sup>(E)</sup> sizing not reliable	detection, <sup>(F)</sup> sizing	detection, sizing not reliable
GOUGES	Detection <sup>(A)</sup> and Sizing <sup>(B)</sup>						no detection
LAMINATION OR INCLUSION	limited detection	limited detection	detection and sizing <sup>(B)</sup>	detection and sizing <sup>(B)</sup>	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”**

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## 4. ILI Technologies

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- 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. ILI Technologies

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Key Operational Improvements include:

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

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## 5. New Developments

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- “Next Generation” Inspection Systems
  - Advances in electronics
  - Advances in hardware and software
  - More robust and sensitive systems.
- Multiple Threats – Combination/“One Tool” Technologies
- Un-Piggable Pipeline Solutions
  - Robotic Inspection Vehicles

## 5. New Developments

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### Industry Drivers for R&D

- Demand
  - The demand for products and services is the main driver for R&D.
- Technology
  - Advances in electronics, hardware and software help drive capabilities for provision of innovative, sophisticated, robust and sensitive systems.

## 5. New Developments

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### Industry Drivers for R&D (continued)

- Efficiency
  - New technologies or processes are improving the ability to reduce response time while improving accuracy, reliability and QA/QC.
- Competitiveness
  - Market forces are promoting new developments and enhanced efficiency.

## 5. New Developments

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

*What's next?*

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## 5. Summary

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



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Thank you.

[www.ILIAssociation.org](http://www.ILIAssociation.org)