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# ILI Tool Performance Guidelines for Pipeline Operators

A Joint Industry Project  
For UKOPA Meeting  
September 2005

*UKOPA/05/0116*



- Understanding the true performance of on / in line inspection (ILI) tools
- Identify factors that influence performance
- Understand how performance affects integrity
  
- Scope driven by operators' needs
- Input from vendors where appropriate

# Objective



- To gain a better understanding of the true capabilities of ILI tools, and the factors that influence performance, so that ILI programmes can be designed to better meet operators' integrity needs

# Outline of Problem



- Pigging companies offer services based on their own performance specifications
  - Sensitivity
  - Accuracy
  - Resolution
- Practical experience is that discrepancies often exist between quoted and achieved performance

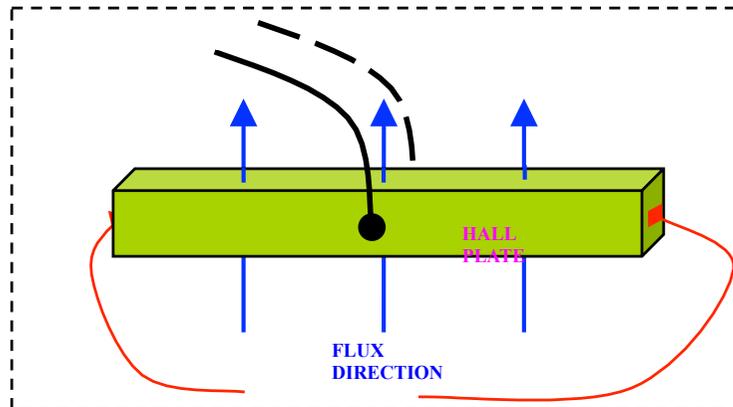
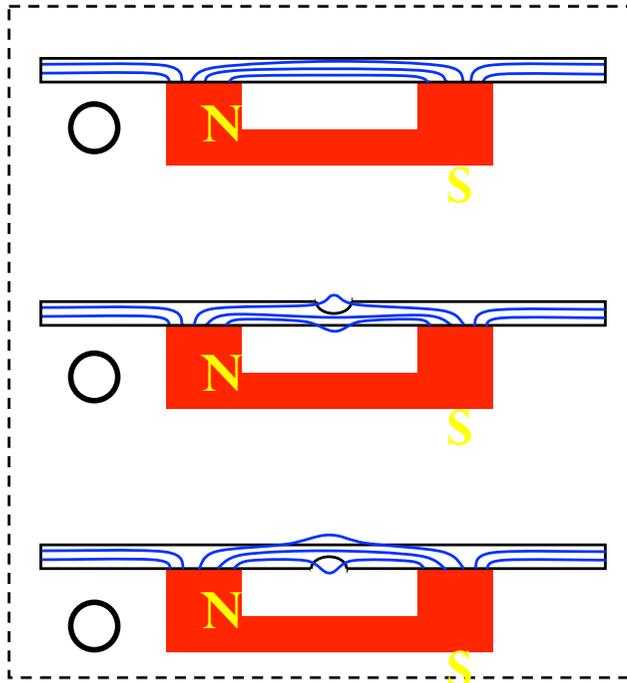
# Key Questions



- What is the true performance?
- What parameters drive the performance?
- What is the impact of performance on integrity management strategy?
  - Immediate / scheduled repairs
  - Re-inspection intervals

# Design Parameters

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# Typical pig parameters



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| Description                | Channels<br>+ width | Scan pitch<br>(mm) | Data Rate<br>(note 1) | Storage for<br>100km |
|----------------------------|---------------------|--------------------|-----------------------|----------------------|
| Low<br>Resolution          | 20<br>104mm         | 4.79               | 6.68 kb/s             | 0.62 Gby             |
| Intermediate<br>Resolution | 80<br>26mm          | 4.79               | 26.7 kb/s             | 2.49 Gby             |
| High<br>Resolution         | 200<br>10mm         | 3.5                | 91.4 kb/s             | 8.52 Gby             |

**Note1: Assumes 32 byte scan for 20 channels and pro rata for additional channels. Rate expresses per metre per second**

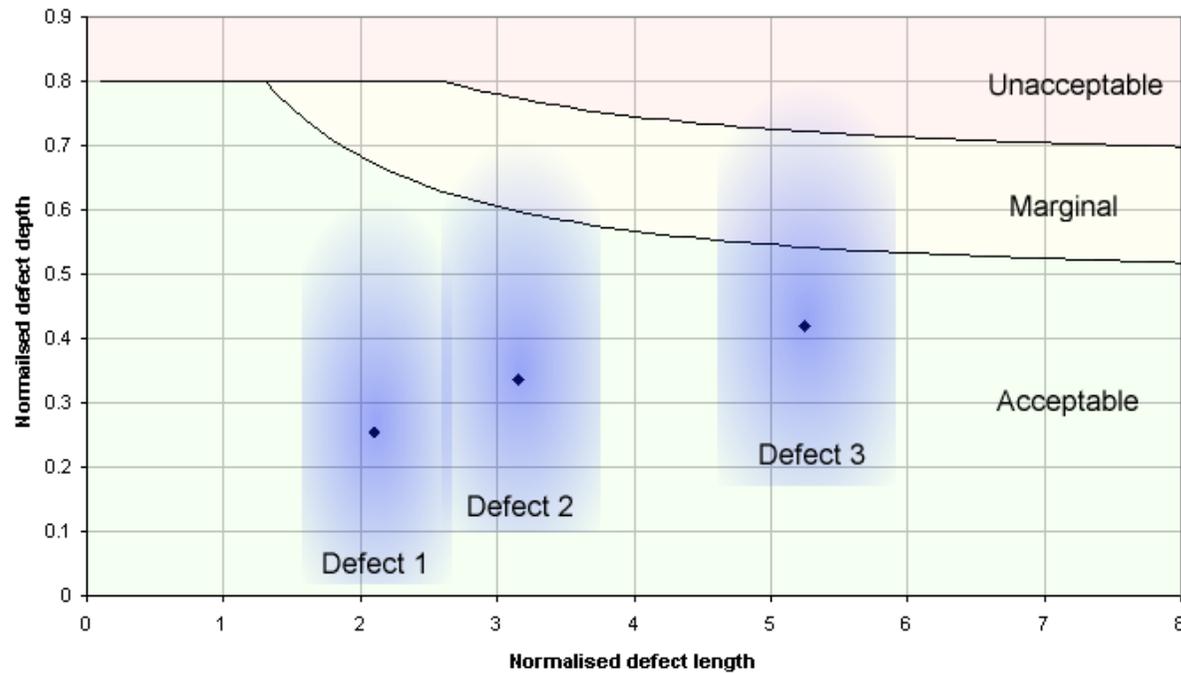
# Estimated Accuracies



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| Accuracy of:               | Detection<br>% wall                | Sizing     |
|----------------------------|------------------------------------|------------|
| Low<br>Resolution          | To be determined<br>experimentally | S, M, L    |
| Intermediate<br>Resolution | 20                                 | $\pm 20\%$ |
| High<br>Resolution         | 10                                 | $\pm 10\%$ |

# Integrity Assessment



*Defect acceptability using reliability based criteria*

- Practical guidance on ILI tool selection
- Better understanding of operational circumstances that impact quality (e.g. cleaning, over-speed conditions)
- When do the results need to be qualified by digs?
- Independent guidance on the impact of performance on inspection, repairs and run schedule (intervals)
- Actual performance capabilities and success rates
- Structure and mechanism for sharing information

# Standards & Guidance



- Pipeline Operators Forum
- NACE
- API

API 1163

**IN-LINE INSPECTION SYSTEMS  
QUALIFICATION STANDARD**

July 9, 2004

API - 1163 QUALIFICATION OF IN-LINE INSPECTION SYSTEMS

FOREWORD

Pipeline Operators, Service Providers, and the Regulatory Community continuously strive to improve the safety and integrity of gas and liquid pipelines.

In-line inspection of pipelines is a key technology utilized by the industry to help maintain systems safety and integrity.

This Standard serves as an umbrella document to be used with and complement companion standards. NACE RP 0102-2002, "Standard Recommended Practice, In-Line Inspections of Pipelines"; and ASNT ILIPQ 2003, "In-Line Inspection Personnel Qualification & Certification" all have been developed to enable Service Providers and Pipeline Operators to provide rigorous processes, that will consistently qualify the equipment, people, processes and software utilized in the in-line inspection industry. The teams that have worked so diligently in the development of these three standards expect improvement in the results from in-line inspections with accompanying improvements in the safety and integrity of gas and liquid pipelines.

Appreciation is extended to the Pipeline Operators Forum for the use of their guide for in-line inspections, "Specifications and Requirements for Intelligent Pigging of Pipelines," Version 2.1, Nov. '98. Portions of this guide were incorporated directly into this Standard.

Appreciation is also extended to the In-Line Inspection Association, whose draft guide provided a running start to develop this and the companion standards reference herein.

This Standard states that performing in-line inspections requires agreements and close cooperation between Service Providers and Operators. This Standard establishes requirements of all parties for the implementation of in-line inspections, and these must be recognized by organizations utilizing the three standards. Service Providers and Operators must have a clear definition of assigned responsibilities in order to successfully apply these standards.

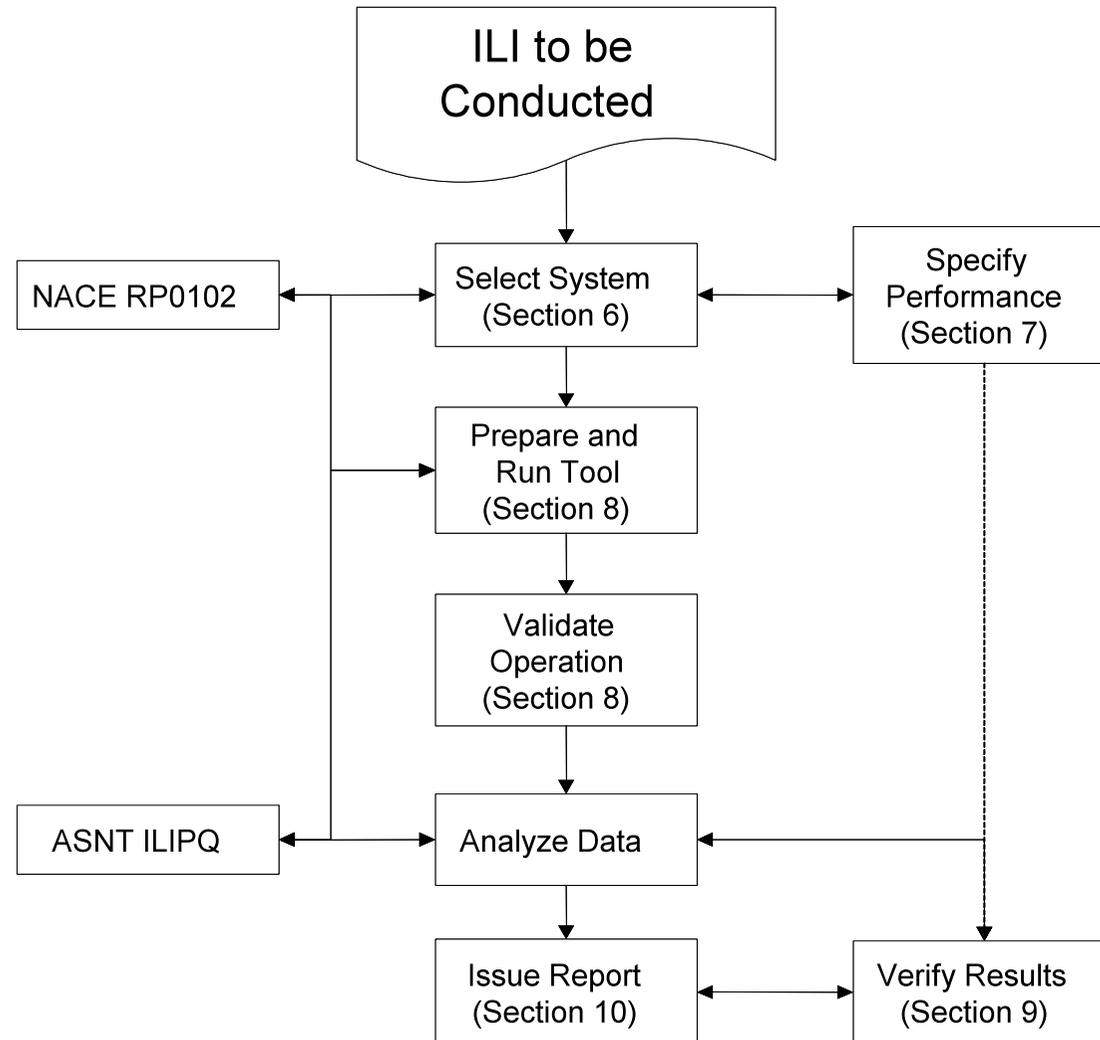
These three standards are neither regulatory documents nor can or should they address commercial issues.

During the development of this Standard, a number of issues of technical significance arose. A process-oriented format was adopted to incorporate the many different technologies applied in various aspects of the exploration and transportation of gas and hazardous liquids. The Standard does not require specific qualification processes to accommodate the differences in the broad range of industry activities. The Standard encourages the development and implementation of new and improved technologies in the future.

The definitions in this Standard are taken from previously developed and accepted documents wherever possible. A significant number of definitions have been modified or clarified for this specific application. Industry is strongly encouraged to uniformly utilize these definitions so that

# API 1163 Process

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# Project Phases & Status



|          |   |
|----------|---|
| <b>6</b> | <b>SCOPE OF WORK .....</b>                            |
| 6.1      | Phase 1 — Project Specification .....                 |
| 6.1.1    | Investigation of Modelling .....                      |
| 6.1.2    | Process Development.....                              |
| 6.1.3    | Inspection Scenarios.....                             |
| 6.2      | Phase 2 — Modelling.....                              |
| 6.3      | Phase 3 — Data Gathering From JIP Sponsors .....      |
| 6.4      | Phase 4 — Analysis and Reporting .....                |
| 6.5      | Phase 5 — Witnessed ILI System Performance Tests .... |

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- Phase 1 in progress, complete by Dec 2005
- Phases 2-4 expected duration 12-18 months
- Phase 1 sponsors BP, National Grid, Gasunie, Gaz de France

# Phase 1 Deliverables



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- Review of MFL inspection methods and technologies
  - design choices, importance of differences between technologies
- A review of factors that can affect the reliability and accuracy of an MFL inspection
  - technological, operational and analytical aspects & qualitative indication of their importance
- Operational influences on performance,
  - speed effects, remnant magnetization, interplay of factors with technology and analysis.
- Current state of the art of system modelling of MFL inspection tools.
- Processes to be used for performance evaluation, based on API 1163.
- A set of inspection scenarios to be considered in Phase 4
- Methods that will be used to ensure statistically valid evaluation of tool performance.
- Analysis of how ILI results can be used for goal-based integrity management, including consideration of how an integrity management programme can take account of errors and gaps in inspection data.
- Sponsors' experience with post-run assessment
- Contractual framework for managing participation in subsequent phases. This will include developing options, costs and strategy for progressing the JIP into follow on phases.

# Funding – Phase 1 (MFL)

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## Phase 1

- Project Specification, Contract Development

## Fixed price

- Approx €20K / \$25K per company

## Phase 2,3,4

- Modelling, Data Gathering, Analysis & Reporting

## Budget estimate

- €250K - €500K

## Phase 5

- Witnessed tests

- Not costed – may not be required

# Role of Pigging Vendors



- No formal involvement during Phase 1
- In-kind supporter and reviewer during Phases 3-5
  - Providing data on tool design
  - Performance specifications
  - Examples of pull through test data
  - Access to inspection reports
  - Discussion of results
  - Possible involvement in performance testing

# Phases 2-4



- Sponsors needed for 2006
- Pursuing PRCI / US Department of Transportation funds in 2007
- Contact either
  - Mike Gardiner +44 1509 282145
  - Clive Ward +44 1434 608407