ILI Related API Initiatives
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PHMSA Research & Development Meeting
September 11-12, 2018 | Baltimore
Outline

- ILI as an integrated system
- Context of API 1160, 1176 and 1179 relevant to ILI
- In process update of API 1163 In-line Inspection Systems Qualification Standard
- In ditch NDE data improvement initiatives
- NDE-4-12 Continuous Improvement of ILI Capabilities Joint Industry Project (Phase I)
ILI as an Integrated System

Quality of the deliverable from the ILI vendor
- Hardware
- Analysis

Ability of the operator to transform ILI data into integrity knowledge
- Data integration
- Consider uncertainties
- Informed interpretation

Ability of the operator to accurately discern ILI quality
- NDE data accuracy
- Sufficiently granular specification
The collection of API documents supporting Integrity

- API RP 1173: Safety Management System
- API RP 1160: Integrity Management
  - API TR 1179: Appropriate Uses of Hydrostatic Testing
  - API RP 1176: Assessment and Management of Pipeline Cracking
  - API TR 1178: Integrity Data Management and Integration
  - API RP 1133: Managing Hydro-technical Hazards
  - API 1163: In-line Inspection Systems Qualification Standard
Dispositioning the ILI calls by operator

For cracking per 1176
- Likely crack
- Possible crack – *significant portion of correlations are false positive*
- Unlikely crack – *stable features that do not grow in gas service and fail as a notch as opposed to a crack (plastic collapse vs fracture mechanics)*
API TR 1178 The Data Management and Integration Guideline

- 1178 empowers informed decisions by facilitating a dataset that is
  - accurate, and
  - comprehensive

- Addresses PHMSA’s statement that, “the ability to integrate and analyze threat and integrity data from many sources is essential for sustaining performance and a proactive IM program.”

- How that data should be interpreted is largely left to other industry documents such as API 1160, 1176 and 1163
API 1164 - scope of 3rd revision

- Beyond a general update, 1163 will be the vehicle to drive a number of API initiatives

General
- Review and align where practicable with current industry documents, including POF, CSA Z662 and API 1176.
- Resolve references and terminology for dents/wrinkles/buckle and such
- Shopping list of feedback for industry solicitation in early 2017
Expand on Severity Based POD and Sizing

- Typically, the larger the feature the better detection
  - Not reflect in current specs

- Performance can be significantly influence by crack morphology/type
  - Typically limited to only delineating weld region and imbedded flaws today

- Increase discretization of features types and tool capabilities
  - severity based POD necessitates clarity on outliers and exceptions

- Clarify interplay of POD and POI
  - POx?
  - POI specific to feature type/subtype – critical in Likely/Possible/unlikely disposition
Provision for Developing Performance Spec based on Integration of Multiple Technologies

- Transparency of interpretation
- Impact of degradation of data from one of the integrated technologies
- Managing score/risk based detection grading that is not definitive
Standardize Deliverables

- Normalized format of performance spec – informative
  - Facilities raising the bar on POD and POI

- Possibly normalized data governance– informative
  - A normalized pipe tally would facilitate aggregation of industry data
  - Capture reporting updates to support dent assessment working group
In Ditch NDE Data Improvement Initiatives

- NDE techniques discussed in API 1176,
  - there was the intent to expand on it in API 1163 given its import in validating ILI data

- NDE techniques being addressed under API R&D working group as new qualification process and associated documentation
  - NDE in ditch techniques and qualification (design to augment current ASNT certification)
  - Blind test administered by a third party
NDE-4-12 Continuous Improvement of ILI Capabilities Joint Industry Project

- Initiated by API’s R&D Working Group

- Purpose:
  - Develop testing protocols with an inventory of test facilities and test spools to better assess ILI tool performance and facilitate ILI performance improvements – initial focus is cracking in liquid service.

- Phase 1 executed as a joint industry project under the umbrella of PRCI

- DNV GL selected as the contractor
### Phase I

<table>
<thead>
<tr>
<th>Task</th>
<th>Task Description</th>
<th>Deliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task I</td>
<td>Research Available Test Facilities</td>
<td>Presentation of the identified pull test facilities, ranked according to determined feasibility, and the anticipated modifications to accommodate testing in a liquid medium</td>
</tr>
<tr>
<td>Task II</td>
<td>Research/Design Test Rig</td>
<td></td>
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<tr>
<td>Task III</td>
<td>Research Methodologies for Manufacturing Cracks</td>
<td></td>
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<tr>
<td>Task IV</td>
<td>Research Real Defect Samples</td>
<td>Written Project Plan</td>
</tr>
<tr>
<td>Task V</td>
<td>Design Defect Population</td>
<td></td>
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<tr>
<td>Task VI</td>
<td>Design Test Matrix</td>
<td></td>
</tr>
<tr>
<td>Task VII</td>
<td>Finalize ILI Vendor Participants and Vendor Buy-In</td>
<td>Presentation of the project plan to key stakeholders and ILI vendors</td>
</tr>
</tbody>
</table>
# Defect Type Delineation for NDE-4-12 and API 1163

<table>
<thead>
<tr>
<th>Crack Type</th>
<th>Examples</th>
<th>Single or Multiple</th>
<th>External, Internal, Midwall</th>
<th>Associated with Weld</th>
<th>Associated with Corrosion?</th>
<th>Associated with Dent?</th>
<th>Axial, Circum, Diagonal, Mixed</th>
<th>Tight, Open</th>
<th>Heavily Branched</th>
<th>Mostly Radial</th>
<th>Weld Type</th>
<th>Detect, Identify, Size?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated External Axial Crack in Pipe Body</td>
<td>Isolated (single or small group) near neutral pH SCC</td>
<td>S</td>
<td>E</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>O</td>
<td>N</td>
<td>Y</td>
<td>Any</td>
<td>D,S</td>
</tr>
<tr>
<td>Isolated External Axial Crack in Pipe Body</td>
<td>Rail fatigue due to stacking on rivets (not very common)</td>
<td>S</td>
<td>E</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>T</td>
<td>N</td>
<td>Y</td>
<td>Any</td>
<td>D,S</td>
</tr>
<tr>
<td>Isolated External Axial Crack in Pipe Body</td>
<td>Isolated (single or small group) high pH SCC</td>
<td>S</td>
<td>E</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>T</td>
<td>Y</td>
<td>Y</td>
<td>Any</td>
<td>D,S</td>
</tr>
<tr>
<td>Isolated external surface breaking parallel-to-wall crack</td>
<td>External slivers and laps (often shallow)</td>
<td>S</td>
<td>E</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>M</td>
<td>O</td>
<td>N</td>
<td>N</td>
<td>Any</td>
<td>D,I</td>
</tr>
<tr>
<td>Isolated External Axial Crack in Dent</td>
<td>With gouge, rerounding crack</td>
<td>S</td>
<td>E</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>A</td>
<td>O</td>
<td>N</td>
<td>Y</td>
<td>Any</td>
<td>D</td>
</tr>
<tr>
<td>Isolated External Axial Crack in Corroded Area</td>
<td>Near neutral pH SCC</td>
<td>S</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>O</td>
<td>N</td>
<td>Y</td>
<td>Any</td>
<td>D,S?</td>
</tr>
<tr>
<td>Isolated External Axial Crack in Dent with Corroded Area</td>
<td>Corroded out rerounding crack or near neutral pH SCC</td>
<td>S</td>
<td>N</td>
<td>Y</td>
<td>A</td>
<td>O</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Any</td>
<td>D</td>
</tr>
<tr>
<td>Isolated External Axial Crack in Longitudinal Seam Weld Heat Affected Zone</td>
<td>External hook crack (ERW, FW)</td>
<td>S</td>
<td>E</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>O</td>
<td>N</td>
<td>N</td>
<td>ERW, FW</td>
<td>D,I,S</td>
</tr>
<tr>
<td>Isolated External Axial Crack along Longitudinal Seam Weld Toe</td>
<td>Near neutral pH SCC (tape coated lines)</td>
<td>S</td>
<td>E</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>O</td>
<td>N</td>
<td>Y</td>
<td>DSAW, SSAW</td>
<td>D,I,S</td>
</tr>
<tr>
<td>External sharp (V-notch) groove in weld</td>
<td>External selective seam weld corrosion</td>
<td>S</td>
<td>E</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>O</td>
<td>N</td>
<td>Y</td>
<td>ERW, FW</td>
<td>D,I,S</td>
</tr>
<tr>
<td>Isolated External Axial Crack in Longitudinal Seam Weld Heat Affected Zone</td>
<td>Hydrogen cracking at seam weld (rare)</td>
<td>S</td>
<td>E</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>T</td>
<td>N</td>
<td>N</td>
<td>DSAW, SSAW</td>
<td>D,I,S</td>
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