Inspection of “unpiggable” pipelines using novel (Alberta) I.L.I. Tools

Dave Russell
World Corrosion Organization:

Quote:

“Annual Cost of Corrosion: $2.2 trillion”

(3% of world GDP)
Unpiggable Pipelines:

- Unable to couple MFL or UT due to internal conditions such as:
  - Epoxy lined
  - Cement mortar lined
  - Polyethylene “Tite Liner” Lined
  - HDPE lined (up to 25mm thick)
  - Heavy internal deposits (wax, scale, tubercles)
¾” HDPE

Thin-film epoxy

Cement Mortar

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Pipelines with Internal Deposits

Eg: Water disposal, raw water, cooling water, fire water, drinking water

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Remote Field Technology (RFT)
Signal Measurement

Nominal

Flaw

Exciter/10^5

Flaw

Nom

Phase shift 57°

Amplitude shift x 2.7
Flaw 27 μV
Nominal 10 μV

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Russell NDE Systems Inc.
May 9, 1961

First run of an RFT “intelligent pig”, Tom Schmidt of Shell Development on right.

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RFT Tools may be Tethered
Pipes may be any ferrous metal:

- Steel
- Cast Iron
- Ductile Iron
- Magnetic stainless

In any service:

- Oil
- Gas
- Water
- Waste Water
- Fire Water
- Slurry
- Disposal well casing
- Chemical
RFT is the BEST choice for LINED pipelines (and some others) because

- It is equally sensitive to ID and OD wall loss
- It is true bi-directional, even around elbows
- It has no sensors contacting the pipe
- It has no brushes or magnetic sliders in contact with the pipe
- It requires hardly any pipe cleaning
- It requires no couplant
RFT Tools provide more info than competing ILI Tools:

- Axial and clock location
- Depth (+/- 15% worst case)
- Length and width
- Local Stress and Strain (from wrinkles, dents, bridging)
- Detection from above ground without additional “locator”
Case Studies:

• Epoxy Lined water disposal line with crack in dent
• HDPE lined sour gas line with internal pitting and grooving
• 12” (300mm) waste water pipeline crossing a marine reserve
Case Study #1: Gen-III 8” RFT Tool

- Target Pipe: 8 Inch Epoxy Lined Pipe.
- Maximum hard OD: 5.625-inch
- Length: 14.5ft.
- Weight: 228 lbs.
- Operation: Free Swimming
- Range: 30km
- Pressure: 700 PSI max
- Bend Capability: >1D
Launch and receiver installations
Defect detected: dent with 97%
Verification Dig:

Dig Sheet for 6" Waste Disposal Line 14-06 (Sheet #1)

Client: 
Pipeline: 
Location: 
Date: 
Launch: 
Receive: 
Method: 
Reference distances: 
NWT: 
Clock Position: 

Dig Excavation Site Facing West

Table:

<table>
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<tr>
<th>GW Locations from DS Marker [m]</th>
<th>Distance from DS Marker [m]</th>
<th>Location of DS Marker [m]</th>
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<tbody>
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<td>1970.96</td>
<td>2044.13</td>
<td>124.19</td>
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GW Locations [m]: 67.87
Joint Lengths: 
GW Locations from US Marker [m]: 51.02

Dig Excavation Site Facing East

Table:

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<tr>
<th>GW Locations from DS Marker [m]</th>
<th>Distance from DS Marker [m]</th>
<th>Location of DS Marker [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>81.74</td>
<td>2058.83</td>
<td>14.8</td>
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GW Locations [m]: 61.61
Joint Lengths: 
GW Locations from US Marker [m]: 46.75

Secondary Indication

Suspected Indications

Suspected Indications from US Marker

Secondary Indication

Additional Information

Visual Inspection

Site Condition

Environmental Considerations

Safety Guidelines
Confirmed Defect: weeping leak in dent caused by pipe sitting on a rock:
Case Study-2:
HDPE lined 8” Sour Gas:

8” x 0.280” Steel Pipe
¾” HDPE liner (grooved)
Approx. 5 years old.
External concrete jacket.
Four segments, up to 5km long.
Transporting Sour Gas
Gen III 8 inch RFT Tool

• Target Pipe: 8” x 0.280” with ¾” HDPE Liner.
• Maximum hard OD: 5.625-inch
• Length: 14.5ft.
• Weight: 228 lbs.
• Operation: Free Swimming
• Range: 30km
• Pressure: 700 PSI max
• Bend Capability: >1D
Tool Calibration:

[Graph showing 1 Inch Diameter Flat Bottom Holes (FBH) Wall Loss (%)]

- 20% WL
- 40% WL
- 50% WL
- 60% WL
- 80% WL
- 100% WL

Equivalent Volume Loss, mm^3
Tool Deployment:
Reporting:

- No Wall Loss over 25% Detected.
- Lines are in good condition
- Inspection repeated in 6 months: same result (data matches)
Case Study#3: 12” (300mm) waste water pipe, crossing marine reserve:

- 12-inch WW Force Main.
- Cement lined DI.
- 40 years old.
- Encapsulated in concrete.
- Environmentally Sensitive water crossing.
Gen III 12-Inch RFT Tool:

- Target Pipe: 12 Inch Lined Pipe.
- Maximum hard OD: 10.625-inch
- Length: 12.5ft.
- Weight: 264 lbs.
- Operation: Free Swimming
- Range: 30km
- Pressure: 700 PSI max
- Bend Capability: 1D (Liner Dependent)
Calibration:
Tool Deployment: Tethered, \( \sqrt{\text{winches on both sides of water}} \)
Results:

- Section under waterway is in good condition.
- On-shore pipe shows localized wall loss.
- Presence of wall loss was confirmed through visual inspection.
- Corrosion possibly related to tidal movement.
Questions?:

Thank You

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