Completing the Impossible: Assessing a Casing with a Pipeline Inspection Robot

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Southwest Gas

Know your pipeline like never before
Agenda

• Southwest Gas system overview
• Southwest Gas integrity management plan
• Pipetel overview
• Explorer
• Overview of Southwest Gas robotic ILI projects
• 10 inch pipe in Scottsdale, AZ
• Conclusions
• Questions
Arizona, California and Nevada

- 1.9 million customers
- 1,524 miles gas transmission pipelines
- 30,435 miles gas distribution main
- 1.85 million gas distribution services
Southwest Gas IMP Stats

HCA Mileage by Division/PPC – 2015
156 Total Miles/558 HCAs

- 57 mi 37% 290 HCAs (CAZ)
- 5 mi 1% 5 HCAs (SCA)
- 68 mi 44% 141 HCAs (SNV)
- 23 mi 14% 66 HCAs (SAZ)
- 7 mi 4% 56 HCAs (PPC)
Southwest Gas IMP Challenges

- Cased Pipe
- DAERs

- DA not applicable; ILI or Pressure Tests Required
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>NYSEARCH – Development of technology funded by various LDCs including <strong>Southwest Gas</strong>, PHMSA, DOE, SDTC etc.</td>
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<tr>
<td>2004</td>
<td>InvoDane – Development of MFL sensor for plug valve</td>
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<tr>
<td>2007</td>
<td>InvoDane – Integration of technologies and field testing</td>
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<tr>
<td>2009</td>
<td>InvoDane – Commercialization of services</td>
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</table>
| 2010 | **Southwest Gas – sponsored 8” pipe demonstration**  
Pipetel formed as service provider |
| 2011 | First commercial Explorer 6/8 inspection |
| 2013 | **Southwest Gas first commercial robotic inline inspection** |
| 2014 | Robotic ILI of cased pipe in Scottsdale, AZ |
Explorer

Hi-res camera & Laser deformation sensor

Drive & battery

Hi res MFL sensor

Articulated joint (roll & pitch)

Drive & battery

Hi-res camera
• Live pipelines up to 750 psi

• Self propelled

• Tetherless

• Axial MFL sensor

• Visual inspection

• Modular

• High, low, or no flow

• No pig trap

• Tees & valves, plug valves

• Back-to-back bends

• Vertical segments
Explorer Sizes 6 to 36 Inches
## Overview of Southwest Gas Robotic ILI Projects

<table>
<thead>
<tr>
<th>Project date</th>
<th>Location</th>
<th>Diameter</th>
<th>Length</th>
<th>Key drivers for robotic ILI</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2013</td>
<td>Las Vegas, NV</td>
<td>6 inch</td>
<td>5,300 ft</td>
<td>• Identify the wall thickness and metal loss threats</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• Lack of infrastructure and flow for pigging</td>
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<td></td>
<td></td>
<td>• Complement direct assessment</td>
</tr>
<tr>
<td>Feb 2014</td>
<td>Scottsdale, AZ</td>
<td>10 inch</td>
<td>500 ft</td>
<td>• Need for IMP assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Vertical offset limits other assessment methods</td>
</tr>
<tr>
<td>Dec 2014</td>
<td>Phoenix, AZ</td>
<td>6 inch</td>
<td>2,600 ft</td>
<td>• Identify the wall thickness and metal loss threats</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Lack of infrastructure and flow for pigging</td>
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</table>
10 Inch Cased Pipe in Scottsdale, AZ

- E Chaparral Rd & N 78th Street, Scottsdale, AZ
- ~ 10 miles northeast from Phoenix Sky Harbor Airport
10 Inch Cased Pipe in Scottsdale, AZ
10 Inch Cased Pipe in Scottsdale, AZ

- 10” diameter pipe inside of a 16” diameter casing
- 40 feet in length
- 400 psi MAOP
- Located under intersection
- 20 feet vertical drop below concrete channel
- Pipe was rerouted via Mueller bottom out fittings
Requirements & Challenges

- Assess 40-feet segment under concrete channel
- Perform assessment with pipeline in-service
- Minimize disrupting traffic at intersection
- Avoid digging up intersection
- Mueller bottom out fittings at top of pipe
- Overcome vertical drop
Potential Solution #1

- Take pipe out of service
- Use Explorer to perform video and MFL inspection
- Launch Explorer 10/14 into pipe on top of existing Mueller fitting
Potential Solution #1

• Benefits
  • Inline inspection of target segment
  • Reduce risk of stranding Explorer
  • Use existing Mueller fitting

• Drawbacks
  • Pipe became out-of-service
  • Excavating and doing work right at intersection
Proposed Solution #2

TDW Stopple Fitting
10 inch 600 lb
To be installed ~400 ft south of Mueller fitting

Mueller Fitting

Approx. 9 ft

Explorer

17 ft

Start of cased segment
Proposed Solution #2

• Benefits
  • Inline inspection of target segment and 400 feet of pipe
  • No interruption to gas services
  • No interruption to traffic at intersection
  • No work/excavation at intersection

• Drawbacks
  • New fitting required to be installed
Installation
Explorer Inspection
During Inspection

12 inch Mueller bottom-out fitting
Video
Results

- Assessment completed in a day
- No interruption to gas services
- Avoided any work at intersection by entering 400 feet from intersection
- Explorer navigated down 20 feet drop into cased segment
- Explorer climbed back up vertical leg
- Performed MFL and video inspection of cased segment under concrete channel and 400 feet of pipe
- Explorer navigated Mueller fitting with pipe remaining in service
Inspection and Exam Results

- Pipe in good condition
- No metal loss or dent of significance was identified
- Direct exams validated inspection
Conclusions

• Robotic ILI continues to grow and improve

• Navigation of tricky installations is possible

• Dry, relatively clean pipelines allow more flexibility in inspections

• Upcoming tool additions will continue to provide more inspection opportunities

• Communications and pre-planning are the key to a successful inspection

• “Unpiggable” is becoming piggable in many circumstances
Questions?

Thank you!