Direct Assessment Forum

PRCI DA History and R&D needs

Harvey Haines
Statistics from 2002 Survey

- **Gas Transmission** - 92,975mi  6 PRCI Transmission members
  - 49% of Transmission Pipelines Piggable
  - 87% piggable in 7-10 years

- **Gas Trans/Dist** - 8700mi  2 PRCI Distribution members
  - 16% of Trans/Dist Systems Piggable
  - 32% piggable in 7-10 years

- **Liquid Pipelines** - 33,479mi  3 PRCI Liquid Members
  - 92% of Liquid Transmission Piggable
  - 93% piggable in 7-10 years

- **DA is needed most in Distribution Systems**
  - but is needed by all types of pipelines
ECDA Historical Reports

- **GRI-02/ 0141, Development of ECDA Methodology**
  - Bubenik & Mooney, Battelle
  - Established need for two complementary tools during indirect surveys
  - Supported NACE RP 0502 development

- **GRI-00/ 0231, Direct Assessment and Validation**
  - Battelle, CC Tech, & Paragon
  - Established ECDA as an alternative integrity technique
# 2004/2005 Reports

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<th>CONTRACTOR</th>
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<td>Comparisons of DA &amp; Other Integrity-Assessment Methods</td>
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<td>Structural Reliability Assessment for ECDA</td>
<td>Advantica</td>
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<td>Pending</td>
<td>A Soils Model for ECDA</td>
<td>Battelle/Marr</td>
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ECDA Participating Companies

10 Datasets from 9 Companies

- CenterPoint Energy
- El Paso
- Enbridge Consumers Gas
- Gulf South
- Panhandle
- SoCal
- Duke Energy Gas Transmission
- Union Gas
- Williams
ECDA Needs — Selection Matrix

- Previous project selected sites from a variety of situations
  - Rural to Urban
  - Single and Multiple Pipelines
  - 1940 to very recent
  - 10, 16, 24, & 30 inch lines
  - Variety of Coatings
    - Most lines Coal Tar or Asphalt
    - Field Applied Tape encountered in Surveys

- Need situations in
  - Station Piping and Crossovers
  - Bare Pipe and tape coating
  - CDA
ECDA Needs — Survey Tools

- Almost always ran at least 3 tools
  - PCM – CIS – DCVG
  - Sometimes ran as many as 6 - 7 surveys
    - Current Attenuation (PCM or C-Scan)
    - CIS (fast cycle & slow cycle)
    - DCVG (several methods including DA meter)
    - ACVG (PCM A-frame)
    - Delta Survey (EUPEC RMS)
    - Soil Resistivity (4 pin Wiener & Geonics)

- Need new tools
  - Cased Crossings
  - Shielded Coatings and Soils
Regions are defined using soil characteristics, history, and inspection tools

- Good published ECDA soil model not yet available
Soil Characterization for ECDA

- Marr has already been modeling EC in non-piggable lines
- Correlation of EC data with extensive soil data sets will allow evaluation for ECDA application without a large investment
- Includes soil characterization, topographical, and drainage surveys
- Draft Report planned for end of March
ECDA & SRA (Structural Reliability Assessment)

- Technique Developed by Advantica (British Gas)
- Uses Failure Frequencies from Experience (Database) of UK Transmission
- Update Failure Frequencies from ECDA Results
  - Using Bayesian Updating
- Result are:
  - Failure Frequency per mile
  - Reinspection Interval
  - Based on Probability theory
- Allows Quantitative Comparison Between DA & ILI
ECDA & SRA (continued)

- Validating SRA by Applying to 5 of the 10 datasets
  - Results comparable to ECDA analysis but quantitative probabilities output

- Also Funding Improvements to the SRA Methodology
  - Will Deliver Methodology in Report Form
ICDA Needs

- **Wet Gas ICDA**
  - Need Standard Development
  - Need Validation

- **Liquid ICDA**
  - Need Standard Development
  - Need Validation

- **Dry Gas ICDA**
  - Need More Validation
  - More understanding in uncertainties due to:
    - Depth measurement uncertainty
    - Modeling uncertainty
    - Flow history uncertainty
Tools R&D

- Long Range Guided Wave UT
- Above Ground Electromagnetic Metal Loss
  - NoPig system
- Modeling circumferential guided waves
- Fluidized Sensors
- MEIS
Long Range UT study at SwRI

- Magnetostrictive Transducer Approach
  - Effort increasing power of transmitter
  - Field trials ongoing to be finished by May 2005

- Need to complete field trials

- Only way to inspect cased crossings
  - without using ILI or hydrotesting

- Cofunded by DOT, NGA and others
Overview of the NoPig System
A system to measure Above Ground Magnetic Field Deflections
Old & New Filters in ERW Pipe

Old filter shows large anomalies across girth welds & misses metal loss

New filter shows 3 defects in joint 3

<table>
<thead>
<tr>
<th>Joint 4</th>
<th>Joint 3</th>
<th>Joint 2</th>
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<tr>
<td>1¼ x 7</td>
<td>4½ x 1½</td>
<td>4 x 7½</td>
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<tr>
<td>x 54%</td>
<td>x 57%</td>
<td>x 60%</td>
</tr>
<tr>
<td>4¼ x 4¾</td>
<td>4 x 7¼</td>
<td>2½ x 3¼</td>
</tr>
<tr>
<td>x 54%</td>
<td>x 60%</td>
<td>x 55%</td>
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Defect depth

16
Preliminary Results  NoPig Field Tests

- **Original system designed for seamless pipe**
  - ERW pipes produce distortions which require special filters
  - Offset in long seam prevented data analysis near girth weld

- **Developed two different filtering algorithms for long seam welds**
  - New filter shows location of significant metal loss
  - Filters out offsets near girth welds
  - New filter shows clock position of long seam
  - Also improves results in seamless pipe
Significant limitations still exist

- Must be less than 1.5 meter depth

- Above ground interference sometimes a problem
  - Cars
  - Metal objects buried in the right-of-way

- Some need for larger pipe diameters
  - 26 – 36 inches

- Need to handle tees, elbows, xcrossings
  - Crossovers
  - station piping
Penn State Modeling study to locate and size SCC and examine attenuation from coating
  • Applicable “in-the-ditch” and for ILI

Current guided wave ILI tools have not been reliable at discriminating SCC from inclusions

3D model allows study of mode conversion should provide more information

Final report looked at coating studies
  • Lack of funding prevented completion of mode conversion studies
 Fluidized sensor study at SwRI

- Goal to look at tiny microbots to look for corrosive fluids inside a pipeline
- Result due in 2006
- Cofunded by DOE and others
Shielded Coating Techniques

- PRCI studied detection of shielded coatings in 1990’s
- Technology used was MEIS

- NGA, SoCal, and others also studied MEIS
  - Application for detecting active corrosion
Conclusions

- R&D helped establish DA as a viable technique for integrity management

- Put DA on equal footing with ILI & hydrotesting

- Future Projects needed to fill in gaps for applying DA
  - Special situations
    - Station piping
    - Crossovers
    - Cased crossings
  - Problematic coatings & soils
    - Shielding
    - Bare Pipe