Evaluation of Intensive CIPS / DCVG Survey Methods
Headline: Purpose

Why?
• Operator Requirements to Evaluate:
  • CP Performance against Relevant Criteria
  • Pipeline Coating Condition

How!
• Traditional Overriding Survey Techniques
  • CIPS
  • DCVG / ACVG / Current Attenuation / Pearson’s
• Emergence of Intensive / Combined Methods

What?
Stand-Alone Surveys v’s Intensive Methods
• Reliability / Repeatability?
  • Efficiency?
  • Cost Effectiveness?
  • Accuracy?
Evaluation of Intensive Survey Methods

**How?**

- Review of Industry Standards / Papers / Technical Guidance
- Identification of Above Ground Survey Techniques / Methodologies
- Discussions / Interviews with Relevant Parties
  - Survey Providers
  - Technology Providers
  - Pipeline Operators
- Review of Operator Experiences

**Study Process**

- Overview of Techniques
- Distribution of Use
  - Questionnaire
  - Operator Experiences
  - Reliability Review
    - Pros and Cons
    - Where and When
  - Future Developments
- Recommendations for Development / Further Clarifications
Study Process Identified the Following Survey Methods

**Stand Alone Methods:**
1. Stand-Alone CIPS
2. Stand Alone DCVG

**Intensive Methods:**
1. Simultaneous CIPS / DCVG
2. Lateral CIPS / DCVG
   a) 4 Person Technique
   b) 5 Person Techniques
3. Trailing CIPS / DCVG
4. Additional ‘Hybrid’ Surveys
   a) Side Drain Cell to Cell
   b) Hot Spot Cell to Cell

**Considerations**
- Overview of Techniques
- Methodologies
- Data Analysis
- Criteria
- Personnel Requirements
- Reference within International Standards
Development of Comparative Scoring Matrix

1. Operational Aspects
2. Personnel Aspects
3. Industry Guidance
4. Data Analysis / Management

<table>
<thead>
<tr>
<th>Weighting Scale</th>
<th>Operational Aspects</th>
<th>Personnel</th>
<th>Industry Guidance / Documentation</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Just one</td>
<td>1</td>
<td>Comprehensively Documented</td>
<td>Good, &lt;6m, Easy</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>2</td>
<td>Comprehensively Documented</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Some</td>
<td>3</td>
<td>Recognised in Standards</td>
<td>Moderate, 6m, Moderate</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>All</td>
<td>5</td>
<td>Reliant on local interpretations</td>
<td>Poor, &gt;6m, Difficult</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Operational Aspects</th>
<th>Personnel Aspects</th>
<th>Industry Guidance</th>
<th>Data Analysis / Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP Current Interruption</td>
<td>Personnel Requirements</td>
<td>Established Methodology</td>
<td>Data Accuracy</td>
</tr>
<tr>
<td></td>
<td>Survey Efficiency</td>
<td>Right Of Way Access</td>
<td>Defined Criteria</td>
<td>Data Alignment</td>
</tr>
<tr>
<td></td>
<td>Execution Complexity</td>
<td>Executive Competency</td>
<td>Coating Defect Assessments</td>
<td>Coating Defect Assessments</td>
</tr>
<tr>
<td></td>
<td>Environmental Competency</td>
<td>Established Methodology</td>
<td>Data Interpretation</td>
<td>Data Interpretation</td>
</tr>
<tr>
<td></td>
<td>Established Methodology</td>
<td>Person Performance</td>
<td>Data Accuracy</td>
<td>Data Accuracy</td>
</tr>
<tr>
<td></td>
<td>Data Accuracy</td>
<td>Data Alignment</td>
<td>Data Accuracy</td>
<td>Data Accuracy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comparative Index per Technique:</th>
<th>Stand Alone CIPS&amp;DCVG combined:</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability Matrix</th>
<th>Stand Alone</th>
<th>Intensive Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIPS</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>DCVG</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Simultaneous CIPS&amp;DCVG</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Lateral 4 person</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Lateral 5 person</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Trailing</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

1. Operational Aspects
2. Personnel Aspects
3. Industry Guidance
4. Data Analysis / Management
Reliability Review

1 – Interruption of Current Sources
- Required for all CP assessments
- Most efficient survey techniques would advantageous
- DCVG requires only local interruption

2 – Survey Efficiencies
- Stand-alone methods advantageous due to;
  - Personnel / operational aspects / two data sets

3 – RoW / Access Requirements
- Significant Issues with Lateral Survey Technique (3-20m)
  - Permissible route
  - Changes in ground resistivity
  - Consider the route in question

4 – Execution Complexity
- Stand-alone methods - Considered straightforward
- Intensive methods - Separation distances may be difficult
- Additional personnel
- Emphasis on the survey lead

5 – Personnel Requirements

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Personnel Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand-Alone CIPS</td>
<td>3</td>
</tr>
<tr>
<td>Stand-Alone DCVG</td>
<td>2</td>
</tr>
<tr>
<td>Simultaneous CIPS / DCVG</td>
<td>4</td>
</tr>
<tr>
<td>Lateral CIPS / DCVG 4 Person</td>
<td>4</td>
</tr>
<tr>
<td>Lateral CIPS / DCVG 5 Person</td>
<td>5</td>
</tr>
<tr>
<td>Trailing CIPS / DCVG</td>
<td>4</td>
</tr>
</tbody>
</table>

6 – Competency
- CP Survey Competency is ‘Grey Area’
- Simultaneous CIPS / DCVG requires two competent survey leads
- Available training course manufacturer specific
Established Methodology

- Comprehensive methodologies for CIPS / DCVG in Int Standards
- Lack of defined methodology for intensive methods in Int Standards
  - Significant discrepancies relating to separation distances

Defined Criteria

- CIPS Criteria documented in all Int standards
- DCVG Criteria – small variations relating to Categorisation
- Sim CIPS / DCVG as above
- Intensive Methods – Often criteria is depicted by the survey operator

Data Accuracy

- All data relies on competent survey process
- Intensive survey issues;
  - Separation distance issue
  - Voltage gradient signal strength
  - ‘Live View’ Issues
  - Establishing Remote Earth

Coating Defect Assessments

Aspects to Consider

- Pin Points
- Sizes (Benchmarking required)
- Corrosion Status
- Assessing multiple / complex defects

Data Alignment

- Benefits with Intensive methods due to single point GPS entry
- GPS Accuracies within the specific regions to be considered

Data Interpretation

- Significant increase in data to manage / analyse when considering intensive methods
- DCVG Data does require some manual translation (equipment dependable)
- Data Interpretation / Analysis International Standards.
Questions Remain?

- **Equipment / Survey Improvements**
- Numerous Manufactures for all CP / Coating Survey Methods
- Multi Channel Data Loggers for Intensive Methods
- Certain Manufacturers claim to have ability to perform add on surveys (ACVG / CA / SR Etc.)
- Comprehensive Data Management Software Packages

**Question marks relating to Intensive Methods ???**
- Consistent Methodology ?
- Access Restrictions ?
- Coating Defect Assessment Accuracy ?
- Coating Defect Criteria ?
- Data Accuracy ?

**Clear Advantages**
- Two surveys in one pass
  - Limiting change in environment
  - Improved data alignment

‘*Know your Pipeline Understand the Challenges’*
Going Forward

**Field Trials**
- Requirement to Understand Limitations / Gaps in Intensive Methods
- Comparable Field Trials of Intensive Vs Stand Alone Methods
- Findings to be shared with all parties

**Onus on Operators**
- Development of Pipeline Specific Survey Strategies to Include:
  - Comprehensive knowledge of Survey Route
  - Understanding Equipment / Survey technologies
  - Defined / Agreed Criteria for Survey Data Interpretation
  - Operational Communications with Survey providers / Information sharing etc.
  - Realistic Expectations
- Data Management Strategy
- Additional Data Sets

‘Avoid reviewing survey / inspection data in isolation’
Click to add text
Thank you for your attention.