Pipeline External Corrosion Confirmatory Direct Assessment

External Corrosion Direct Assessment Seminar-Houston, Texas
Aida Lopez-Garrity, P.Eng.
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Kiefner and Associates, Inc.
585 Scherers Court
Worthington, Ohio 43085
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TG 377 Scope

- Prepare a standard that will provide guidelines on how to implement the CDA methodology as part of the pipeline integrity re-assessment process.
- The standard only concentrates on external corrosion (EC)
TG 377 Members

- Roy Fultineer – Equitable Resources
- Drew Hevle – El Paso Corporation
- Randy Hodge – Scana/PSNC
- Joshua Johnson – PHMSA
- Keith Lewis – P-Pic
- Norm Moriber – Mears
- Joe Pikas – Impro-Technologies
- Alberto Valdes – GE
- Mike West – PG&E
- Dan Wagner – Marathon Petroleum (TG Vice-Chair)
- Aida Lopez-Garrity – Kiefner & Associates (TG Chair)
Reference Documents

- NACE Standard RP0502-2002 Pipeline External Corrosion Direct Assessment Methodology
- ASME B31.8S Non-Mandatory Appendix B Confirmatory Direct Assessment (External Corrosion only)
- IMP Rule
Document Outline

- General
- Definitions
- Pre-Assessment
- Indirect Inspections
- Direct Examinations
- Post Assessment
- ECDA Records
- References
- Bibliography
- Appendices
CDA PROCESS

- The CDA process is considered an intermediate assessment technique used to verify and validate:
  - Previous implemented pipeline integrity processes (ECDA, ILI, pressure tests)
  - Previously established corrosion rates
  - Previously established re-assessment intervals
CDA vs. Reassessment Intervals

- The ECDA process has been embraced by the industry and included in regulatory documents pertaining to pipeline integrity management plans.

- Reassessment Intervals from previous ECDA applications indicate that CDA should start to be implemented between 2009 and 2010
EC-CDA Applications (assessment of EC on pipeline segments)

- Cannot be inspected using other common inspection methods (such as ILI or pressure testing).
- Have been inspected using other inspection methods as a method of managing future corrosion.
- Have been inspected with another inspection method as a method of establishing a reassessment interval.
EC-CDA Limitations

- Standard can be applied to poorly coated or bare pipelines in accordance with the methods included in NACE RP0502.
- This standard can only be applied to pipelines that have been previously inspected by techniques capable of identifying and locating External Corrosion.
Four Step Process

- EC-CDA requires the integration of data from multiple field examinations and from pipe surface evaluations.
Pre-Assessment

- Definitely needed in those cases where the previous integrity applied process corresponded to ILI or hydrotest (refer to RP 0502)
- Is it really needed in those cases where DA was previously applied? Keep in mind that this is a confirmatory process
- Of course!!!!. Existing operating conditions can be verified during the Pre-assessment Step.
Pre-Assessment

- If a data element exits from a previous assessment, it should be updated with those items that have changed and may affect the definition of regions or the selection of indirect inspection tools.
- If no previous data element exists, one should be established.
Pre-Assessment
CDA Feasibility Assessment

- If an ECDA has been successfully completed on the pipeline segment, then CDA may also be feasible for that segment.
Pre-Assessment
CDA Feasibility Assessment

- If neither an ECDA or CDA process has been previously applied then the pipeline operator shall integrate and analyze related historical data to determine whether conditions exist for which indirect inspection tools cannot be used to determine a differential change in wall thickness with time.
Pre-Assessment
CDA Feasibility Assessment

- A prior integrity assessment (i.e. ILI or pressure test) may be used if the operator:
  - Can demonstrate with supporting evidence that the corrosion rate has not increased with time.
  - The operator must show that defects observed during the previous integrity assessment have not grown in depth and length (known or assumed) to exceed the corrosion limits set out in ASME B31.8S, Table 3 and 4 of the ECDA document, during the time interval represented by this new CDA assessment.
Pre-Assessment
CDA Feasibility Assessment

- If there are locations along a pipeline segment at which indirect inspections are not practical, the CDA process may be applied if the pipeline operator uses other methods of reassessing the integrity of the location. Field verification of pre-assessment data might be needed at this point.

- The other methods of reassessing integrity must be tailored to the specific conditions at the location.
Pre-Assessment
CDA Feasibility Assessment

- If the conditions along a pipeline segment are such that indirect inspections or alternative methods of reassessing integrity cannot be applied, this standard CDA process is no longer applicable.
Indirect Inspections

- The pipeline operator shall select a minimum of one indirect inspection tool for all locations and regions where CDA is to be applied along the pipeline segment.
- If the previous assessment method was ILI, then a minimum of one indirect inspection tool shall be selected.
Indirect Inspections

- If the previous assessment method was pressure test, then a minimum of two complementary indirect inspection tools shall be selected in accordance with RP 0502.
Indirect Inspections

If the previous assessment method was another technology, then the operator shall consider the appropriate number and type of tools based on the capabilities of the other technology to identify and evaluate external corrosion defects and conditions leading to further external corrosion.
## Indirect Inspections

**Table 3. EC-CDA Tool Selection Matrix**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>CIS</th>
<th>DCVG</th>
<th>ACVG</th>
<th>Pearson</th>
<th>Electromagnetic</th>
<th>LRGW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating Holidays</td>
<td>2</td>
<td>1,2</td>
<td>1,2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Near River or water crossing</td>
<td>2</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1</td>
</tr>
<tr>
<td>Under Frozen ground</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>NA</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Shielded corrosion act</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1</td>
</tr>
<tr>
<td>Shorted Casing</td>
<td>2</td>
<td>1,2</td>
<td>1,2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cased Crossing</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>NA</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
### Indirect Inspections

**Table 3. EC-CDA Tool Selection Matrix**

- **Notes:**
  - 1 = Applicable (Small coating holidays…)
  - 2 = Applicable (Large coating holidays…)
  - 3 = Applicable (with additional considerations)
  - 4 = N/A
Indirect Inspection
Alignment and Comparison

- If a pressure test or inline inspection was the previous assessment, then when EC-CDA is applied for the first time, the pipeline operator should endeavor to make classification criteria as stringent as practical. In such cases, indications for which the operator cannot determine whether corrosion is active should be classified as severe.
## Indirect Inspections
### Table 4. Example Severity Classification

<table>
<thead>
<tr>
<th>Tool Environment</th>
<th>Minor</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS, aerated moist soil</td>
<td>Small dips or ON and OFF above CP criteria</td>
<td>Medium dips or OFF potential below CP criteria</td>
<td>Large dips or On and OFF potentials below CP criteria</td>
</tr>
<tr>
<td>DCVG, ACVG or Pearson Survey, similar conditions</td>
<td>Small indication</td>
<td>Medium indication</td>
<td>Large indication</td>
</tr>
<tr>
<td>Current Attenuation Surveys</td>
<td>Small increase in attenuation per unit length</td>
<td>Moderate increase in attenuation per unit length</td>
<td>Large increase in attenuation per unit length</td>
</tr>
<tr>
<td>Long Range Guided Wave</td>
<td>&lt;20%</td>
<td>21 to 50%</td>
<td>&gt;50%</td>
</tr>
</tbody>
</table>
Indirect Inspection Alignment and Comparison

- After indications have been identified and classified, the pipeline operator shall analyze the results from the indirect inspections to determine if they are consistent with previous surveys and operating history.
- If the pipeline determines that the results from indirect inspections are not consistent with the pre-assessment results and prior history, and the root cause is not identifiable, then the operator should re-assess EC-CDA feasibility and EC-CDA region definition.
Indirect Inspection
Alignment and Comparison

- If the pipeline determines that the results from indirect inspections are not consistent with the pre-assessment results and prior history, and the root cause is not identifiable, then the operator should re-assess EC-CDA feasibility and EC-CDA region definition.
Direct Examination
Guidelines for Determining the Required Number of Direct Examinations

- Immediate: All indications that are prioritized as immediate require direct examination, unless data gained from the initial direct exams and a common root cause justify a downgrade of the prioritization.
- The need to conduct direct examinations of indications that are reprioritized from immediate to scheduled may follow the guidelines for scheduled indications.
Scheduled: Some defects that are prioritized as scheduled require direct examination.

- If an CDA region contains scheduled indications and it contained one or more immediate indications, at least one scheduled indication must be subjected to direct examination in the CDA region at the location considered most severe by the pipeline operator. If the previous assessment was a pressure test all immediate and a minimum of two additional direct examinations shall be performed on the highest priority indications remaining.
Direct Examination
Guidelines for Determining the Required Number of Direct Examinations

There are two conditions that need to be satisfied:

- If the results of an excavation at a scheduled indication show corrosion that is deeper than 20% of the original wall thickness and that is deeper or more severe than at an immediate scheduled repair indication, at least one more direct examination is required.

- When CDA is applied for the first time, a minimum of two additional direct examinations shall be performed.
Monitored: Defects in the monitored category may or may not require excavation.

- If an CDA region contains monitored indications but the CDA region did not contain any immediate or scheduled indications, one excavation is required in the CDA region at the most severe indication.
- If the prior assessment was a pressure test, a minimum of two direct examinations shall be performed.
When CDA is applied for the first time, after an initial Pressure Test assessment, the pipeline operator:

- Should not downgrade any indications that were originally placed in the immediate or scheduled priority category to a lower priority category.
- IF an ILI or ECDA assessment preceded the initial CDA, then downgrades are acceptable.
Post-Assessment
Corrosion Rate Calculations

- The corrosion rate for each region should be calculated per NACE SP0502, Appendix D and compared against the corrosion rate calculated in the preceding assessment.
- If the corrosion rate is less than or equal to the previously determined rate, the assessment interval is confirmed or may be adjusted based on the new corrosion growth rate.
Post-Assessment
Corrosion Rate Calculations

- If the corrosion rate exceeds the rate determined in the preceding assessment, the interval between assessments must be reduced based on remaining life calculations using the new corrosion rate applied to the most severe scheduled indication.
Post-Assessment
Reassessment Intervals

- EC-CDA is utilized to verify or adjust the reassessment interval established in the previous integrity assessment for each region. In the figure below, the previous reassessment interval is represented between A and B. EC-CDA is used at time C to verify information and predictions from the previous assessment.
Post-Assessment
Reassessment Intervals

- If the information from the EC-CDA correlates with the assessment interval defined in the previous assessment, the reassessment interval is confirmed and the reassessment interval between A and B remains valid.

- If the EC-CDA determines a lower corrosion rate than the previous assessment, the reassessment interval may be extended past B.
If the corrosion rate established in the EC-CDA is greater than determined in the previous assessment, the interval between A and B is no longer valid and the operator must determine a new reassessment interval based on the new corrosion rate.
Summary

- Acceptable engineering assessments will need to be in place before and during the application of a CDA process.
- Balloting process starts on January 30\textsuperscript{th}, 2009.
- Review of balloting results: Corrosion 2009, Atlanta, Georgia.