Pipeline Integrity Program

Pipeline Integrity Rule

- For All Transmission Pipelines Defined 192
- High Consequence Areas
- Integrity Management Plan

Regulations

- 49CFR Part 192 Subpart O
  - NACE RP-0502-2002
  - ASME B31.8S-2001

Direct Assessment

- Can only be used for evaluating corrosion threats.
- External Corrosion Direct Assessment (ECDA)
- Internal Corrosion Direct Assessment (ICDA)
- Stress Corrosion Cracking Direct Assessment (SCCDA)
- Confirmatory Direct Assessment for interim assessments, External & Internal

External Corrosion Direct Assessment

- Must follow NACE RP-0502-2002
- Pre-Assessment
- Indirect Assessment
- Direct Assessment
- Post Assessment

Step 1. Pre-Assessment

- Pipe Information
- Construction Related Information
- Soils & Environment
- Corrosion Control
- Operational Parameters
- NACE RP-0502 Table 1

Data Integration

- Integrate all data from past and present to determine the current status of the segment
- Major Data integration is aligning the pipeline to the surface; making sure the spatial lay out matches what is actually underground.
- Third Party Damage and all foreign crossings need to be located spatially.

Feasibility

- Certain conditions can preclude a successful ECDA.
- Lack of CP currents can prevent tools from doing their job. (soils, structures)
- Excessive time to take a reading
- Accessibility to the pipeline
- Electrical interference from structures or other sources.
- Cased piping and pipe shielding

Tool Selection

- Minimum of two indirect inspection tools per ECDA region
- Tools must be selected based on their ability to detect corrosion or coating holidays under the conditions encountered.
- Tools must be complementary
- NACE RP-0502 Tables 1&2 for tool selection Matrix

ECDA Region

- Different pipe installations, operating, and corrosion history will set up different regions.
- Different tools will yield different regions
- Casings and pipe crossings can be in separate regions
- Different coatings and soil conditions can yield different regions
- Identical regions do not have to be contiguous.

Initial ECDA Regions

- 49CFR 192.925 requires more stringent criteria for initial ECDA on a region:
- Defining a larger set of critical data to determine if ECDA is feasible
- Breaking ECDA regions into smaller more defined pipe section and characteristics.
- Possibility of selecting more than the minimum of two tools

Step 2. Indirect Assessment

- Perform Indirect Inspections
- Identify & Align Indications
- Classify Indications
- Integrate Indication Data

Indirect Assessment

- Mark and accurately identify the ECDA region to be assessed.
- Perform indirect assessment using at least two inspection tools within a short time under the same conditions. (same season)
- Use NACE RP-0502 or manufacture for spacing recommendations.
- Determine reading variation parameters
- Positioning measurements to eliminate spatial errors

Identify & Align Indications

- Perform tool validation checks
- Data Collection
- How information will be aligned
- Identification of indications
- Aligning the physical location of the indication

Classifying Indications

- Classify all indications to specific parameters
- Resolve all conflicting indications between tools
- Any unresolved indications must be inspected
- Compare with pre-assessment and historical data

Initial ECDA Regions

- 49CFR 192.925 requires more stringent criteria for initial ECDA on a region:
- conservative classification & magnitude of indication for urgency of excavation
- Repeat indirect inspections to verify and correlate readings
- Perform additional tool validation checks

Integrate Data

- Past inspections and known results
- Past corrosion & operational data
- Any possibility of third party damage
- Other parameters that may affect the results

Step 3. Direct Examination

- Prioritizing indications identified
- Conducting Excavation & Data collection
- Measuring Defects and metal loss
- Determining the remaining strength of pipe
- Pre-forming Root Cause Analysis
- Evaluating the process

Evaluating Process

- Reclassification of indications
- Mitigative actions taken for reclassification
- Prior corrosion worse than assumed
- Active corrosion worse than predicted by indirect assessment
- Corrosion less than predicted by indirect assessment

Initial ECDA Regions

- 49CFR 192.925 requires more stringent criteria for initial ECDA on a ECDA region:
- Require additional excavations
- Additional Testing
- Additional data collection at each excavation
- No reduction in classification or priority NACE RP-0502 section 5.9.1.2

Step 4. Post Assessment

- Remaining Life Calculation
- Determining re-assessment interval
- Conducting a validation or effectiveness check of the ECDA process
- Performance measures of long term effectiveness of ECDA

Conclusion ECDA

- All the steps must be detailed and followed in the written ECDA Plan
- References must be followed in 192, NACE RP-0502-2002, ASME-B31.8S-2001.
- Any new methods for evaluation must be provided 6 months prior to the use of the method for review by Federal and if applicable State pipeline safety offices.

Dry Gas Internal Corrosion Direct Assessment

- Dry gas process only. This is defined as tariff quality gas 7 pounds of moisture per million cubic feet of gas. Includes parameters for composition.
- Currently only parameters approved by code in 49CFR 192.927.
- Meet all parameters of 192 and ASME B31.8S-2001
- No approved wet gas process currently

Part 192.927 Outline

- Pre-Assessment
- Region Identification
- Direct Assessment
- Post Assessment

192.927 Special Provisions

- 192.927 (c)(5)(ii) states: Apply more restrictive criteria to each step on first use
- 192.927 (c)(5)(iii) States: Perform ICDA analysis on the entire pipeline that contains a covered segment, except remediation is limited to the covered segment.

Step 1. Data Collection

- Data Outline in Part 192 and ASME B31.8S-2001
- Conditions that could preclude ICDA such as;
- Electrolyte in areas that the model would not predict from cleaning pigs or past water test
- Wet gas flow incomplete (current or past)
- Routine and frequent dehydration facility upsets

Step 2. Determine ICDA Regions

- Locate all inputs and outputs this should include past locations
- Run Flow Model in GRI 02-0057(other models can be used if the model is meets the requirements of 192)
- Produce inclination profile
- Determine hold up locations

Step 3. Identify Locations for Excavation & Direct Examination

- Review the results of the model and identify the locations for excavation.
- Determine if the locations are in a covered segment
- Excavate locations in a covered segment
- Conduct a detailed evaluation of the pipe condition.

Examination Finds Internal Corrosion

- Evaluate the Severity and remediate
- Perform additional excavation or testing for additional conditions
- Evaluate similar segments both covered and non-covered segments.

Step 4. Post Assessment Evaluation & Monitoring

- Effectiveness of the Process
- Re-Assessment Interval
- Continuing Monitoring for Internal Corrosion
- If corrosion found continue evaluation for source of problem
- Determine the effectiveness of the ICDA
- Uncorrelated Results require alternative assessment methods

Wet Gas ICDA

- Submit Notification to use “other technology”
- Develop ICDA plan suitable for wet gas applications
- Justify any type of model used

Conclusion

- Past records of no internal corrosion does not eliminate this threat
- Lack of records does not eliminate this threat
- 192.927 and ASME B31.8S-2001 must be followed for dry gas only.
- A detailed written plan must be completed before conducting the process

Stress Corrosion Cracking Direct Assessment

- 49CFR 192.929 mandates use of ASME B31.8S-2001
- Locate, Confirm, and Mitigate SCC
- Combination of screening criteria and bell hole or hydro-test assessments
- Screening estimated to locate 2/3 to 3/4 SCC
- NACE RP0204-2004 available as resource

Types of SCC

- High-pH SCC or Classical SCC are cracks that are inter-granular and typically branched and associated with an alkaline electrolyte with pH about 9.3
- Near-neutral-pH or Low-pH SCC are cracks trans-granular and has limited branching associated with some corrosion with a near-neutral pH.

SCCDA Requirements

- Develop a specific written plan with the following;
- Data gathering and integration
- Assessment methods

Data Collection

- Per ASME B31.8S-2001 Appendix A3
- Age of pipe
- Operating stress and temperature
- Distance of segment from compressor station
- Coating type
- Past Hydro-test records and SCC failures

Criteria for SCC

- High pH
- Operating Stress> 60% SMYS
- Operating Temp. > 100F
- Distance from compressor ≤ 20 mi.
- Age of pipe ≥ 10 yr.
- Coating other than FBE

- Low-Near Neutral-pH
- Operating Stress> 60% SMYS
- No temp. constraints
- Distance from compressor ≤ 20 mi.
- Age of pipe ≥ 10 yr.
- Coating other than FBE

SCC Assessment Methods

- For segments with in service SCC leaks or ruptures; hydro-test within 12 month and develop hydro-test plan
- For segments at risk of SCC; bell hole inspection & examination or hydro-test
- Code requirements for assessment methods per ASME B31.8S-2001 Appendix A3

SCC Remediation

- Bell hole inspections & Evaluation finds: No SCC recoat & evaluate interval for future inspections, SCC present repair or replace, perform hydro-test on section, perform Engineering Critical Assessment
- Hydro-test Fails: written hydro-test plan, retest intervals must be justified or Engineering Critical Assessment to crack growth & Safety
- Code requirements for remediation per ASME B31.8S-2001 Appendix A3 section 3.4

SCC DA Conclusions

- 49CFR 192.929 & ASME B31.8S-2001
- NACE RP-0204-2004 can be used as a resource
- All segments meeting the criteria for SCC must be assessed for SCC
- A written plan for SCCDA must be followed

Confirmatory Direct Assessment

- 49CFR 192.937(5) Confirmatory direct assessment when used on a covered segment that is scheduled for reassessment at a period longer than seven years.
- 49CFR 192.931 Outlines the parameters of Confirmatory direct assessment
- Only valid for Internal & External corrosion

CDA Intent & Basis

- Same ECDA & ICDA principals /technique
- Cannot be used as base line assessment or to extend the interval for conducting a full reassessment
- Interim assessment method for 7-year re-inspection for PSIA of 2002
- Validate corrosion growth rates & mitigation measures from previous assessment methods

CDA External Corrosion

- 49CFR 192.925, NACE RP-0502, ASME B31.8S, Exceptions:
- May use one indirect inspection tool for indirect inspection
- At least one High Risk Scheduled indication excavated in each ECDA region

CDA Internal Corrosion

- 49CFR 192.927, ASME B31.8S Exception:
- Only one High Risk Indication excavated in each ICDA Region

CDA Remediation

- Defects requiring remediation prior to next scheduled full assessment must:
- Use NACE RP-0502 section 6.2 & 6.3 to determine re-assessment interval
- Immediate indications require a pressure reduction per 49CFR 192.933 to remain in place until the next full assessment is completed.

Re-Assessment Intervals DA

- Written process is required for determining Re-Assessment Intervals
- Maximum Intervals Specified in 49CFR 192.939 & ASME B31.8S & NACE RP-0502
- Interim Assessment $\leq$ 7-years
- Re-Assessment Intervals based on 30% of SMYS

Re-Assessment Intervals
≥ 30% SMYS

- If Re-Assessment Interval is > 7-years:
- Perform CDA or Primary method within 7-years
- Followed by primary Re-Assessment at established interval
- Re-Assessment Intervals can not exceed 192.939 values unless deviation is permitted by 192.913(c).
- Primary Re-Assessment Interval determination:
- Evaluation of results or ASME B31.8S table 3

Re-Assessment Interval < 30% SMYS

- If Re-Assessment Interval is > 7-years:
- Perform CDA or Primary method within 7-years
- Can use primary method, CDA, or low stress re-assessment
- Full assessment with primary assessment ≤ 20 years

Re-Assessment Interval for Prior Assessments

- Prior integrity assessment conducted before December 17, 2002 as a baseline assessment
- Initial re-assessment must be conducted by 12/17/09
- If the interval between the assessment date and 12/17/09 is > than the maximum interval a primary assessment must be completed
- If the re-assessment interval is past 12/17/09 an Interim method may be used

Re-assessment Interval Implementation

- Use appropriate re-assessment interval in 49CFR 192.939 or ASME B31-8S-2001 table 3.
- Be able to provide adequate documentation
- Technical bases to support intervals selected

Credits

- CYCLA Corporation for information provided
- DOT RSPA for information provided
- PA PUC for formatting the information