Pipeline Integrity Management

Allied Corrosion Industries, Inc has assembled a group of pipeline assessment specialists to provide cost effective solutions and compliance with regulatory requirement associated with DOT/OPS Title 49 CFR Part 195 (Liquid Pipelines), and CFR Part 192 (Natural Gas Transmission Pipelines).

External Corrosion Direct Assessment

External Corrosion Direct Assessment (ECDA): As defined by the NACE Standard RP0502-2002, External Corrosion Direct Assessment (ECDA) is "a structured process that is intended to improve safety by assessing and reducing the impact of external corrosion on pipeline integrity". The ECDA process consists of four major steps:

Pre-Assessment
ACI´s professionals are well suited to the task of collecting historic and current data to determine if ECDA is feasible and to select the appropriate indirect inspection methods for each individual pipeline integrity program.

Indirect Inspection
A combination of two or more of the following indirect inspection techniques are used to identify coating faults, anomalies, and/or corrosion activity:

- Close Interval Surveys (CIS)
- Direct Current Voltage Gradient (DCVG)
- Alternating Current Voltage Gradient (ACVG)
- Soil & Water Analysis
- Electromagnetic Surveys
- Pearson Surveys
- Global Positioning Surveys (GPS)
- Depth of Cover Surveys (DOC)

Direct Examination
After completion of the indirect inspections, the assessment specialists at Allied Corrosion analyze the data to select sites for excavations and pipe surface evaluations. The direct examination´s data is examined together with prior data to determine the existence and severity of external corrosion on the pipeline. Our integrity specialists can evaluate the coating performance, provide corrosion measurements, pipe strength calculations, corrosion rate estimates, and root cause analysis during this step.

Post Assessment
This step involves analysis of data collected from the previous three ECDA steps to determine the effectiveness of the ECDA processes, establish pipeline integrity, and set future reassessments intervals

Allied Corrosion has the qualifications and the specific technical expertise required to assist you with any of the appropriate ECDA filed services or manage your entire Pipeline Integrity Management program. Corrosion prevention solutions are our business----our only business!

All work is performed in accordance with the NACE Standard RP0502-2002, "Pipeline External Corrosion Direct Assessment Methodology".

Dry Gas-Internal Corrosion Direct Assessment

Dry Gas- Internal Corrosion Direct Assessment (DG-ICDA): As defined in the NACE Standard SP0206-2006 Dry Gas Internal Corrosion Direct Assessment (DG-ICDA) for gas lines is a detailed examination of locations along a pipeline where liquids could first accumulate, allowing inferences to be made about the integrity of the remaining downstream length of pipe. The DG-ICDA process consists of four steps:

1. **Pre-Assessment**
   The pre-assessment phase requires historical and current data collection, which is used to determine feasibility and identify regions for DG-ICDA. To minimize the interference with the operator´s day to day operations, we normally provide a list of the minimum data elements required, along with a list of additional data elements requested if available. The actual collection of data, though normally performed by the operator, can be performed by our staff if requested.

2. **Indirect Inspection**
   Utilizing sub-foot accurate GPS and a depth recording digital pipe locator, all connected to a data logger utilizing Utilimapper software, a pipeline elevation profile is created from data collected over the operator´s pipeline. This data, in conjunction with the multi-phase flow modeling calculations determined by our liquid hold-up software is presented in both graphical and tabular form.

Automated Ultrasonic Corrosion Mapping System

3. **Direct Examination**
   The objective of the direct examination step is to identify three consecutive potential liquid hold-up locations that are free of internal corrosion. The best case being, that no internal corrosion is found at the first three locations examined. The direct examination is accomplished by excavating the pipeline at predetermined intervals along the entire segment identified as a potential liquid hold-up location.

   Utilizing Long Range Guidedwave Ultrasonic equipment, the pipe segment between excavations is inspected for anomalies. All anomalies indicated by the GUL inspection are then

Guidedwave Ultrasonic Inspection

excavated and examined utilizing our Automated Ultrasonic Corrosion Mapping System. This system provides documented results verifying the existence or nonexistence of internal, mid-wall, or external anomalies. It performs the inspection using raster scan technology at sample intervals as fine as every .04 of an inch with speeds reaching 10 inches per second. In addition to examining the condition of the pipeline at each excavation, our pipeline integrity management team can design and install internal corrosion monitoring systems, ranging from permanently installed GUL transducer belts to coupons. These types of installations can ultimately save the operator large expenditures in excavation cost.

4. **Post Assessment**
   The objective of this step is to determine the effectiveness of the whole DG-ICDA process and to determine reassessment intervals. Utilizing all of the information collected throughout the entire process, we can provide the operator with written documentation discussing the functions performed during each step of the DG-ICDA methodology. The effectiveness, along with suggested improvements to the applications of DG-ICDA are included in this documentation.

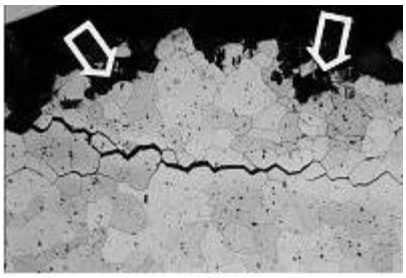
   Our Pipeline Integrity Management Staff is ready to provide turn-key DG-ICDA services or any portion of the methodology an operator requires. Our goal is to provide you with the highest quality of professional customized Direct Assessment Services that you require. We are available to meet all of your DA needs. Please contact one of our Pipeline Integrity Management Specialists to discuss how we can assist you in meeting your requirements.

Stress Corrosion Cracking Direct Assessment

Stress Corrosion Cracking Direct Assessment (SSCDA): As defined in the NACE Standard RP0204-2004, Stress Corrosion Cracking (SCC) is the cracking of material produced by the combined action of corrosion and tensile stress (residual or applied). SCC Direct Assessment Methodology is a procedure that can identify areas where either near-neutral-pH SCC or high-pH SCC can occur on external pipe surfaces. The SCCDA process consists of four steps:

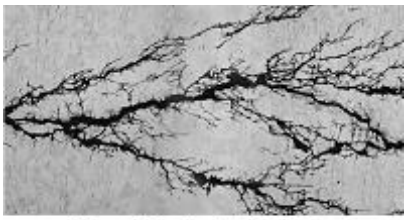
1. **Pre-Assessment**
   In the pre-assessment step, ACI´s or the owner/operator´s personnel will collect historical and current data for the purposes of analyzing and prioritizing the threat of SCC. Prioritization of SCC susceptible pipeline segments is performed utilizing the following factors:

   - **High-pH SCC**
     - Operating stress exceeds 60% of SMYS
     - Operating temperature exceeds 100°F (38°C)
     - Within 20 miles of a compressor station
     - Age greater than or equal to 10 years
     - Coating type other than Fusion Bonded Epoxy



High-pH SCC
(Intergranular)

- **Near Neutral-pH SCC**
    - Operating stress exceeds 60% of SMYS
    - Within 20 miles of a compressor station
    - Age greater than or equal to 10 years
    - Coating type other than Fusion Bonded Epoxy



Near-Neutral-pH SCC
(Transgranular)

2. **Indirect Inspection**
   The purpose of the indirect inspection step is to collect additional information that was not available in the owner/operator´s historical records. Some of the data that ACI could collect in this step would include data from Close Interval Surveys (CIS), Direct Current Voltage Gradient (DCVG) surveys, and terrain conditions (soil type, topography, and drainage) along the right-of-way (ROW) in which the pipeline is located. Once all of this information is assembled, the direct examination site list is finalized and prioritized.

3. **Direct Examination**
   The purpose of the Direct Examination step is twofold. First, this step will either validate or nullify the decision criteria for SCC direct examination site selection. Second, this step provides for the actual digging of the suspected SCC locations for inspection. When performed, these dig sites will render the severity, extent, and type of SCC (intergranular or transgranular cracking). This information is crucial in the post assessment process in order to develop a predictive model and allow for modifications. A wide range of related physical data is collected, along with Magnetic Particle Inspection (MPI) of the susceptible area. NACE Standard RP0204-2004 outlines four different MPI techniques for inspecting the external surface of pipelines. They are:

    - **DPMI- Dry Powder MPI**: The ultimate sensitivity of this inspection technique is 2 to 5 mm long defects.
    - **WFMPI- Wet Fluorescent MPI**: The ultimate sensitivity of this inspection technique is 1 mm long defects.
    - **WVMPI- Wet Visual MPI**: The ultimate sensitivity of this inspection technique is 1 to 2 mm long defects.

BWCMPI Inspection

    - **BWMPI- Black on White MPI**: The ultimate sensitivity of this inspection technique is 1 to 2 mm long defects. This technique is preferred over the other due to the ease of photographic documentation and maintaining a high sensitivity.

4. **Post Assessment**
   In the post assessment step, ACI or the owner/operator will analyze the data collected from the previous three SCCDA steps for the following purposes:
    - To determine if SCC mitigation is required and if so, prioritize those actions.

- To define the time interval to re-assess the pipeline segment.
- To evaluate and verify the decision model used to find SCC.

Our Integrity Management Team is ready to provide turn-key SCCDA services or we can perform any single or multiple step(s) that you, the owner/operator require.