

PROBLEM

Pipeline Integrity Management regulations require the evaluation of all potential threats within a High Consequence Area (HCA). Unlike multi-threat integrity assessment methodologies such as inline inspection or hydrostatic testing, Operators who elect to use Direct Assessment (DA) can be faced with performing both ECDA and ICDA in order to satisfy the regulations. The use of two DA methods has the potential to extend the overall inspection duration, in addition to significantly increasing the cost as a result of the additional excavations required.

SOLUTION

Structural Integrity has developed a **written procedure (ICDA Plan)** to address the potential for internal corrosion within a covered pipeline segment. Our integrated engineering-based approach considers all necessary information to determine the likelihood for Internal Corrosion activity through a structured, formal evaluation process.

Enhanced Pre-Assessment activities establish whether the potential for liquids exist in the system and then progressively escalate the investigation to determine whether the physical pipeline design and operating conditions would support the collection of water – a necessary criteria for internal corrosion.

Increased understanding of the operating parameters can be used to supplement the risk threat assessment for a pipeline or network of pipe, indicating that ICDA is not required, possibly opportunity monitoring might be a more effective option. Conversely, the results may indicate a greater threat than previously anticipated. Structural Integrity has both the engineering and field inspection services to perform all activities outlined in Figure 1.

For many normally dry gas systems, the availability of comprehensive historical operating information required by the regulation to demonstrate the absence of an Internal Corrosion (IC) threat is scarce. The absence of leaks associated with internal corrosion is not enough to conclude Internal Corrosion is not a threat. This lack of data has led to risk models using default (or worst case) conditions, yielding an increased IC risk potential. Sufficient information is necessary to qualify: (1) If the threat of Internal Corrosion is Likely (more so than just a potential); and when truly necessary, (2) base subsequent ICDA integrity assessments on a sound engineering procedure with clear decision criteria.

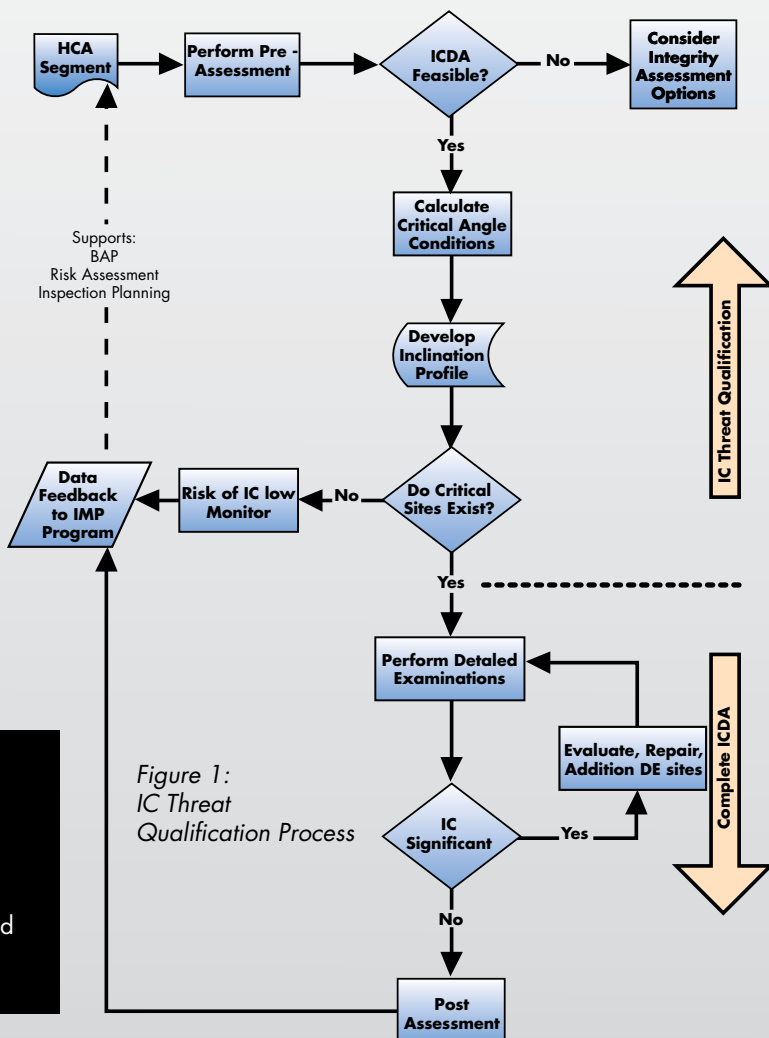


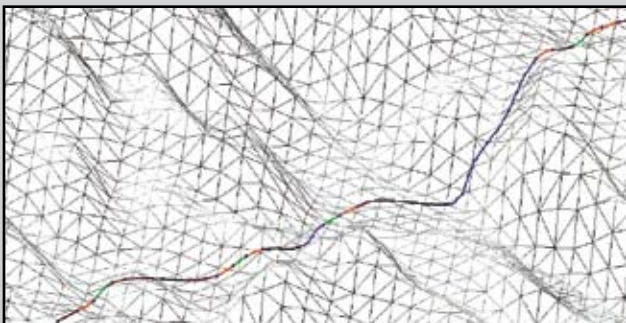
Figure 1:
IC Threat
Qualification Process

Projects typically follow two major emphasis areas:

1. Develop a practical and compliant operating procedure to conduct DG-ICDA on identified pipeline segments.
2. Utilizing the new procedure, initiate the ICDA investigation and perform the Pre-Assessment and ICDA Region Identification activities on covered segments previously inspected via ECDA.

ICDA Threat Qualification

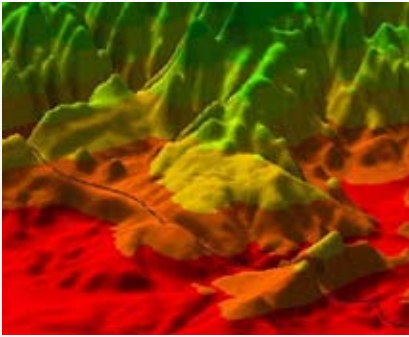
ICDA Threat Qualification includes the review of existing Internal Corrosion risk model information, in addition to integrating specific internal corrosion data as defined in the ICDA procedure. At the conclusion of this step, a formal report is prepared **documenting if the risk of internal corrosion is likely**. If IC is unlikely no further integrity assessment actions are required. For some pipelines, this eliminates the expense of excavations and future inspections



The ICDA Threat Qualification activity includes:

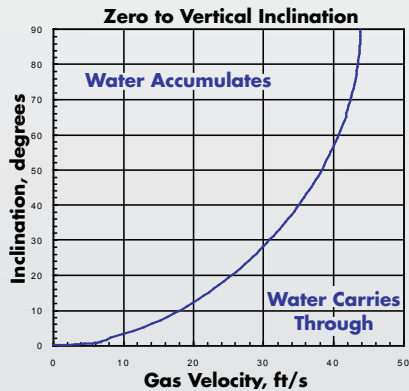
- Pre-Assessment to determine ICDA Feasibility
- Establish ICDA Regions based on defined criteria
- Develop a representative elevation profile along the pipe segment, adjusting for known depth of cover variations (i.e., drilled crossings, drips, bridges)
- Determine if the potential for liquid hold-up exists (IC not a threat)
- Locate Internal Corrosion suspect areas on a map & recommend excavation sites



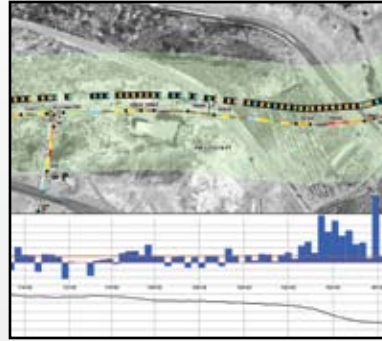


One of the greatest barriers to implementing an ICDA methodology is knowledge of the pipeline profile so an **Inclination Assessment** can be performed. Structural Integrity has developed, in cooperation with a premier PODS™ data model provider, a rapid, low cost inclination assessment tool. The tool

utilizes readily available USGS digital elevation model datasets to build a 3-D profile of the pipeline. Aligning the pre-assessment information with this virtual pipeline elevation model, a reasonable inclination assessment can be achieved yielding effective Internal Corrosion conclusions.



The final results from the Region Identification activity will be summarized and presented in both a graphical and tabular form. A license-free ArcGIS viewing tool, ArcReader™ (similar to Acrobat Reader for PDF files or GeoPDFs), are provided to review the inclination calculations and critical site predictions.



Published Map Files (PMF or GeoPDFs) are provided with every project and include: pipeline centerline; elevation and inclination results, local roads, RR, water features; and aerial imagery (when available).

- The added benefits of the PMF reporting format are:**
- Allows for visual confirmation of pipeline centerline to minimize errors introduced by data misalignment
 - Comprehensive database of aligned and calculated IC data types, including site photos
 - Facilitates site selection and excavation planning
 - Provides ease of data analysis
 - Data can be easily returned to a company's GIS or enterprise database

The time required to complete the internal corrosion threat qualifications is relatively short and can be performed without the time or expense associated with field-based methods. This method is best suited for pipelines with no prior history of corrosion and transports normally dry gas. For pipelines with a stronger potential for internal corrosion, or those in which a liquid sampling program (i.e., from drips, taps, etc.) indicates the presence of water or bacteria, more precise inclination methods are encouraged. Cost avoidance of unnecessary excavations can be significant.

Complete ICDA -- Integrating Guided Wave UT (GWUT)

To complete the ICDA analysis, finalizing the selection of sites for excavation and selecting/performing associated non-destructive testing at each site is required. In addition to Structural Integrity's strength as an engineering services group, we are also a premier provider of GWUT services. The Structural Integrity PLS inspection staff has inspected the equivalent of approximately 850 miles of pipeline using an estimated 30,000 individual LRUT inspection shots of above-ground and buried pipe applications. With 9 crews utilizing the latest GUL™ G-3 equipment, certified Level I and Level II operators, Structural Integrity has the capability to complete your ICDA

assessment project needs. Structural Integrity has also assisted many operators prepare the necessary DOT notification documentation that covers the key decision criteria critical to obtaining acceptance for using GWUT as part of an ECDA program.

Our engineers have developed new analysis techniques to improve the confidence associated with interpreted GWUT information, and can integrate these results to yield improved corrosion growth rate analyses and reinspection intervals – all key considerations in an effective ICDA program.

Why Choose Structural Integrity?

- Engineering:** Pipeline Integrity Engineers, each with over 20 years of industry experience, manage the success of your project to insure meaningful, interpreted, and insightful results. PLS engineers have extensive backgrounds related to integrity management of pipelines, development of operating procedures, and material specifications, failure analysis, welding engineering, corrosion monitoring, indirect examinations, assessment of pipeline damage, and pipeline metallurgy. The staff has been significant contributors to the development of various NACE International standards (including the ICDA standard) and API standards.
- Technology:** Structural Integrity only uses GUL™ Wavemaker equipment, known as one of the leading makers of GWUT equipment – including the latest G-3.
- Expertise:** We only use GUL™ Certified Level I and Level II operators, with all final results reviewed by a GUL™ Certified Level II – one of only 3 in the North America. Training and certification is directly from the manufacturer – Guided Wave Ultrasonics Ltd., insuring the highest quality possible. We have over 8 years of experience using GWUT with over 30 clients in the US. We have inspected: Casings, Insulated Pipelines, Buried Plant Piping, Boiler Tubes, water systems, and other Difficult to Access sites.
- Value:** We know how important accurate results are to your ability to make safe operating decisions. Our team is focused on providing useful and meaningful information – not just data. Let our team of highly trained GUL technicians and Integrity Engineers help you meet your goals.
- Capabilities:** SI is positioned to handle full-service IMP, ECDA, ICDA, and SCCDA program needs. The SI staff and Material Science Lab in Austin, TX are recognized experts in all aspects of structural integrity analysis, including:
- failure analysis
 - fatigue and creep analysis
 - stress analysis
 - structural monitoring and instrumentation
 - fracture mechanics
 - metallurgy and materials
 - nondestructive testing
 - corrosion & corrosion control (CP systems)