

on Fabricated Gate and Compressor Station



By: **SCOTT RICCARDELLA**
■ sriccardella@structint.com



RAY GARDNER
■ rgardner@structint.com

Per the Pipeline Safety Act of 2002 and subsequent Integrity Management rules, regulation mandates that gas transmission pipelines have baseline assessments of all High Consequence Areas completed by December 17, 2012, using one of the following assessment methodologies:

1. Inline inspection tool (ILI tools) or tools capable of detecting corrosion, and any other threats to which the covered segment is susceptible,
2. Pressure tests conducted in accordance with subpart J of CFR 192,
3. Direct assessment to address each corrosion threat through its respective program: External Corrosion Direct Assessment (ECDA), Internal Corrosion Direct Assessment (ICDA), and Stress Corrosion Cracking Direct Assessment (SCCDA),
4. Other technology that an operator demonstrates can provide an equivalent understanding of the condition of the line pipe.

PHMSA response to FAQ #84 clarifies that integrity assessment provisions of the rule apply to all line pipe, including pipe that may be in the boundaries of a facility (compressor stations, metering stations, etc.). These stations can prove very difficult to assess using the traditional accepted assessment methodologies as the segments can consist of several short runs with tight bends and various tie-in and connection points limiting the ability to inspect using ILI tools or pressure testing.

In addition, these facilities can pose some significant challenges to the use of Direct Assessment, a programmatic approach based on engineering fundamentals to assess pipeline integrity consisting of the following four-steps:

- Pre-Assessment
- Indirect Inspection
- Direct Examination
- Post Assessment

The data collection and analysis process for facilities is typically much more challenging, as stations can have multiple pipelines varying in design

Above Grade Piping for Direct Examination ————
Buried Piping for Direct Examinations ————

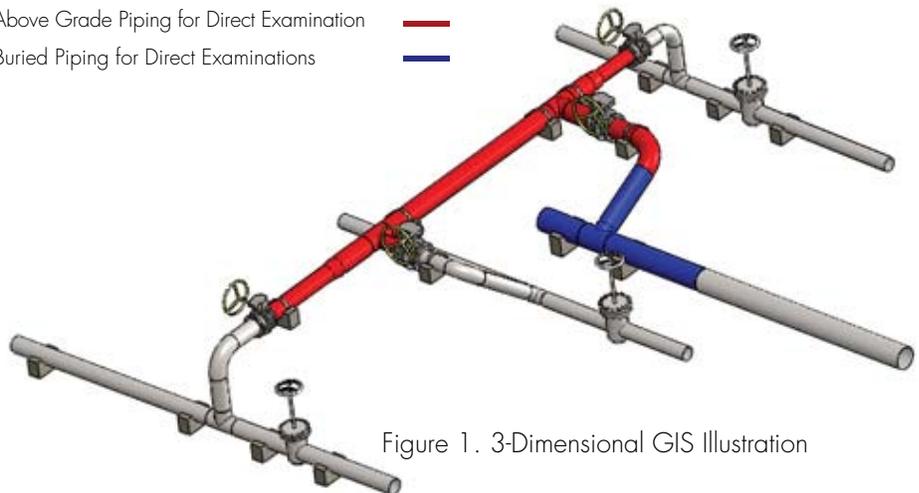


Figure 1. 3-Dimensional GIS Illustration

characteristics, operating parameters, and varying degrees of corrosion susceptibility throughout the facility. Drawings may not be accurate and data, if documented, is likely to be spread across multiple and disparate sources. Additionally, traditional indirect inspection tools may have limited effectiveness and excavations can be complicated by unusual depth and multiple pipelines in the dig region.

To help address these challenges, Structural Integrity designed and implemented an advanced Direct Assessment program incorporating unique tools to enable assessment of these difficult to assess segments.

PRE-ASSESSMENT

Pre-assessment involves collecting information regarding the design factors, construction, operation, and other historical

pipeline and facility records to determine the feasibility of direct assessment and establish segmented regions for assessment.

As part of the pre-assessment step for facilities, a site walk-down is performed to validate drawings and collect missing data elements. Data and drawings are then digitized and consolidated into a Geodatabase and incorporated into GIS and 3-Dimensional CAD drawings for a complete relational mapping and orientation of the piping and attributes throughout the facility. An example of the drawings is shown in Figure 3. Using these modeling tools, we can better organize, analyze, and manage the pipeline data and facilitate the completion of pre-assessment forms as well as identify the proper indirect inspection tools. In addition to assisting in the analysis, the database output also results in more organized and auditable data records.

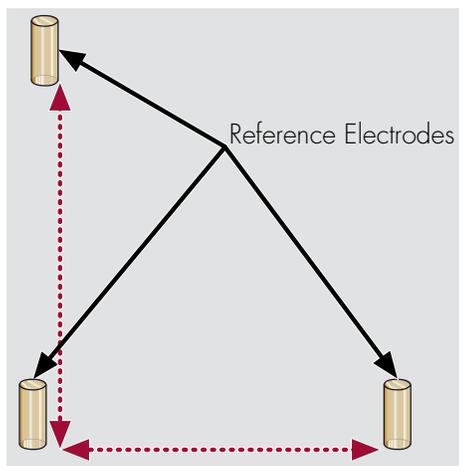


Figure 2: APEC Reference Electrodes Schematic

INDIRECT INSPECTION

The indirect inspection step consists of collecting and analyzing field data to supplement the pre-assessment data and prioritize areas likely to exhibit corrosion. Using the Geodatabase and 3D drawings created in pre-assessment, selection of appropriate tools and survey techniques can be more easily identified. In some cases, traditional ECDA indirect inspection tools such as Close Interval Survey (CIS), Direct Current Voltage Gradient (DCVG), and Alternating Current Voltage Gradient (ACVG) may be suitable. These techniques collect data associated with cathodic protection levels and coating conditions, the two main elements of external corrosion

control. In other areas, where a congested area of piping exists, such as those found at most facilities and generating plants, additional structures may influence the potential measurements of the structure intended to be assessed. Low potential indications may be a factor of adjacent structures, not a lack of coating or cathodic protection.

To improve the interpretation of indirect inspection measurements, Structural Integrity uses the APEC indirect survey technique as an additional and complementary survey technique. APEC is a combined CP survey technique that collects area potential (AP) measurements based on a modified CIS approach, in combination with an evaluation of the earth current (EC) movement using an enhanced three-half cell DCVG methodology as shown in Figure 2. In a facility, it is important to know where any corrosion cell is operating and where CP currents are flowing. When CP system rectifiers are cycled “ON” and “OFF”, the migration of CP current around the facility can be understood and used to adjust and balance the overall performance of a CP system.

Determining ICDA excavation locations can also be a difficult process as the piping is likely to be routed throughout the facility and have several inclination changes and changes in dimension. Using 3D GIS and CAD-based models, flow variation among different segments can be bracketed and an analysis can be performed so that excavation selection can be targeted to areas most likely to accumulate liquid.

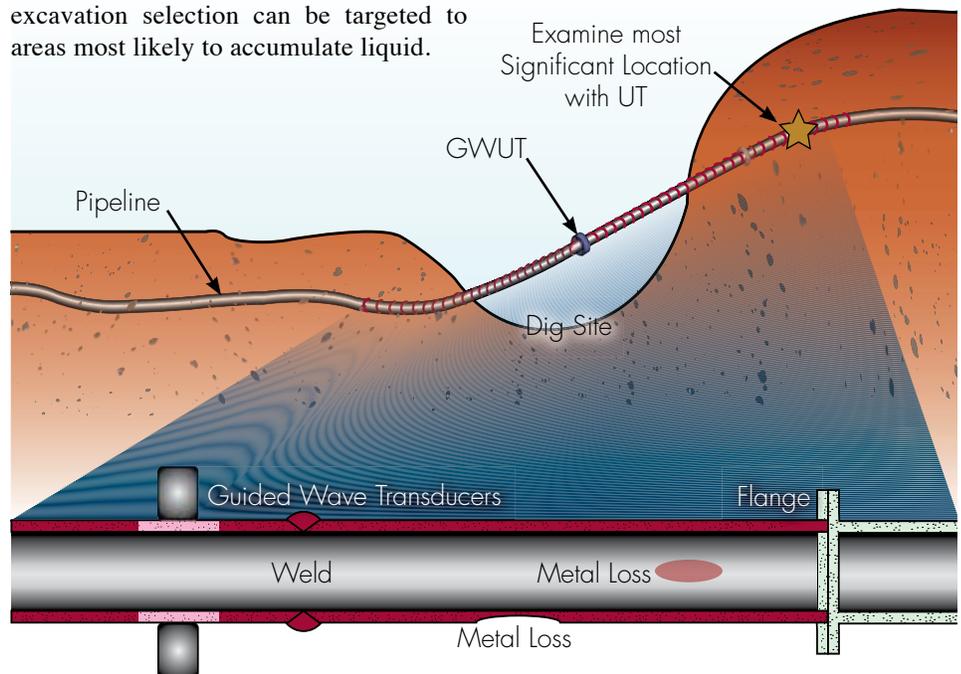


Figure 3. Illustration of GWT Screening in a Bell-hole

DIRECT OR DETAILED EXAMINATION

Direct or detailed examination consists of excavating and examining the pipeline at the areas identified and prioritized during indirect inspection. We employ teams of inspectors experienced in a large range of advanced indirect inspection and NDE methods. Our inspectors are certified in accordance with ASNT protocol and capable of performing a variety of NDE inspection techniques, including Bell-hole examinations in accordance with NACE protocols (SP0502 and SP0206). In addition, we can supplement these inspections with more advanced tools such as Guided Wave Testing (GWT) to rapidly screen the excavation (shown in the illustration below) and provide additional screening outside of the excavation to locate and target areas for additional evaluation.

POST ASSESSMENT

The post-assessment step consists of analyzing the results from the previous step to determine whether repairs are required, determining the effectiveness of the approach, and identifying future mitigation and remediation actions, as well as a re-assessment interval. With all data from previous steps stored in an electronic format and GeoDatabase, data and results of the assessment can be easily viewed, validated, and documented. In addition, because all assessment data is stored in an easily accessible, electronic format, future assessments should prove more efficient and less costly to implement.