Alberta NDE & Pipeline Service Inc.(**ANP**)

Pipeline Integrity and Maintenance Capabilities

2022

Alberta NDE & pipeline Service Inc.

Alberta NDE & pipeline Service Inc.(**ANP**), located in Calgary, is an independent consulting company. We provide leading-edge service in pipeline integrity & maintenance and supply high-quality NDT products to the whole inspection industry.

Pipeline Integrity is a core service for **ANP,** supported by a team of engineers. Most of us have a good reputation and over 20 to 30 years of experience in pipeline integrity from either an operator's side or consulting services perspective. We are a team with an abiding passion for tackling and solving complex problems so that we will provide a value-added engineering solution for pipeline operators.

Vision

Delivering a responsible service resource for all Pipeline and NDT inspection industry

Products

We provide engineering support with excellence in responsible consulting resources for:

- Pipeline Pressure Testing,
- Pipeline Integrity & Maintenance, and
- NDE equipment and supplies.

Partners

SIUI is our Strategic Partner, not only supplying all NDT equipment and parts but also supporting NDE solutions.

APC & Intertek AIM have allied with **ANP** to deliver sustainable pipeline Integrity consulting and inspection services.

RBICode is our business partner in China for industry association and committee affairs.

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PIPELINE PRESSURE TESTING

– Engineering Assessment Service

The Engineering Assessment (EA) will provide optimal or appropriate strength and leak test pressures and durations. We specialize in integrity hydrotest of ERW Vintage Pipe, Low design MOP or/and Class requirements. Our expertise on the balance of strength testing pressure and failure risk will help you reduce the overall cost by reducing failure times and still reach a certain integrity Confidence Level.

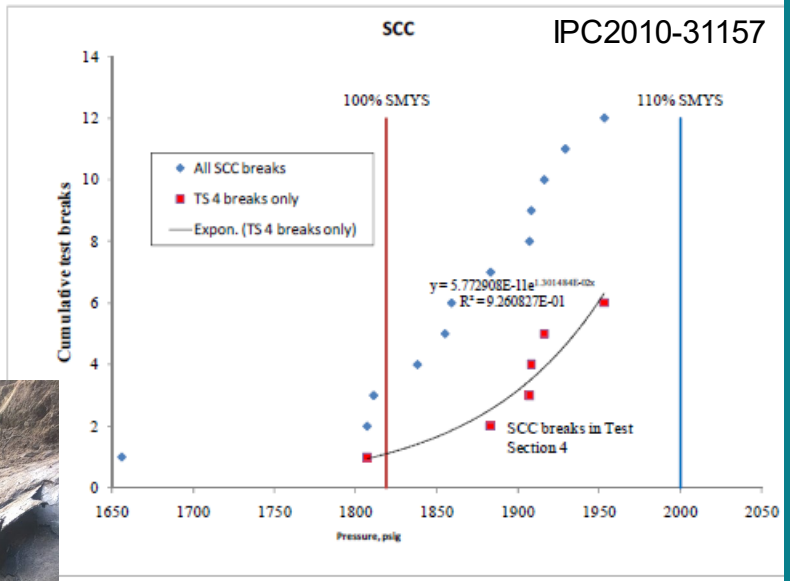


Figure 2: HT strength pressure vs failure risk

Figure 1: HydroTest failure location and ruptured pipe

To manage the SCC threat of the 1950's vintage ERW Pipe, a hydrotest is a necessary approach beyond the EMAT ILI limitation with critical failure recurring, as shown in Figure 1, whereas the Strength Testing pressure is higher than 100%SMYS.

Figure 2 shows the rupture risk trend with strength test pressure above 100%SMYS. SCC breaks will increase following the higher strength test pressure, even though the budget will limit the cost. The balance point will be valid for increasing confidence level after several failures.

ILI DATA INTERPRETATION AND VALIDATION

ANP has used its developed Tool (**ILISure**) for validating MFL ILI data as found since 2006. The **ILISure** tool evaluates in-ditch corrosion findings in terms of ILI MFL response in time and effectively for corrosion management and corrosion growth. We also conduct an Integrity Assessment of In-line Findings, including Corrosion, SCC, Weld Defects, Mechanical Damage, Life Prediction, and Re-inspection intervals.

The interpretation and validation results will reduce any conservatism associated with more. Accuracy.

Consequence of ILI performance

- Non-conservative response
  - Failure to respond
- Over conservative response
  - Failure to resource

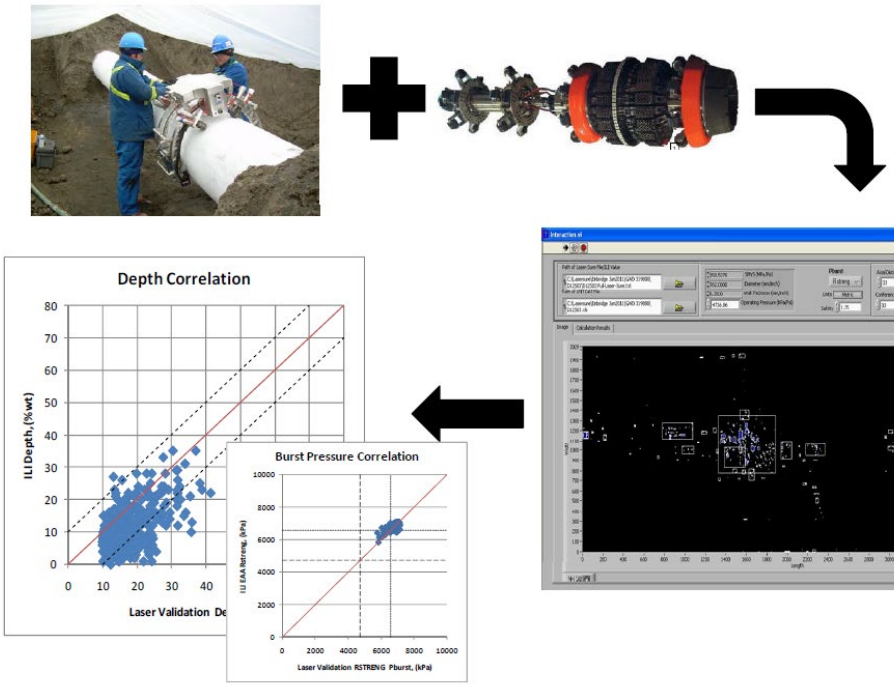


Figure 3: ILISure Process

Evaluation of ILI data can support safety

- Adjust the dig response
- Adjust the ILI

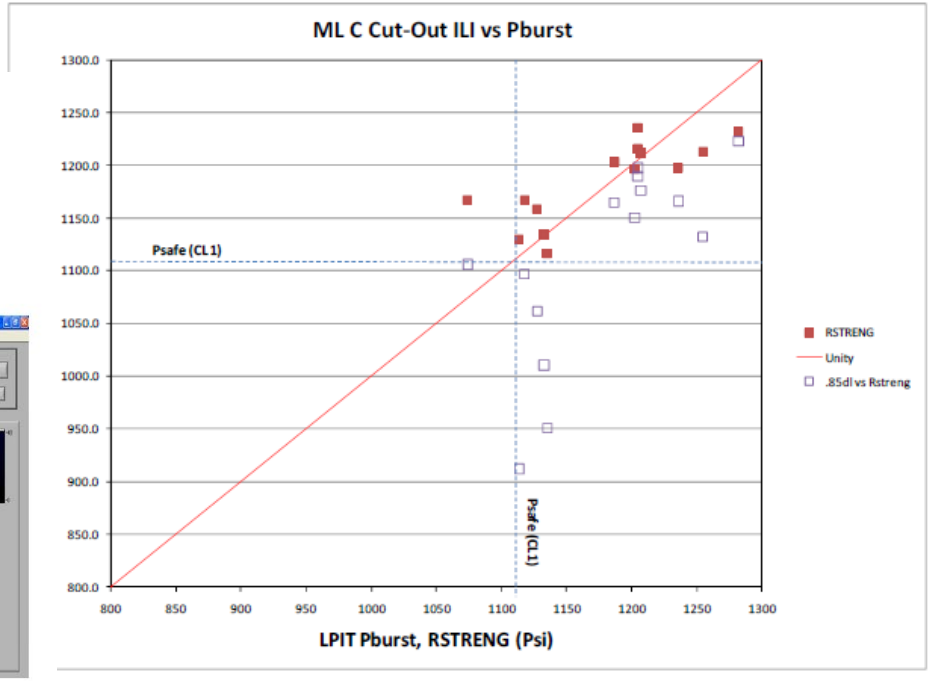


Figure 4: Failure Pressure from ILI and in-ditch Laser Scan

STATISTICAL ANALYSIS OF ILI DATA

--- Unity Plot

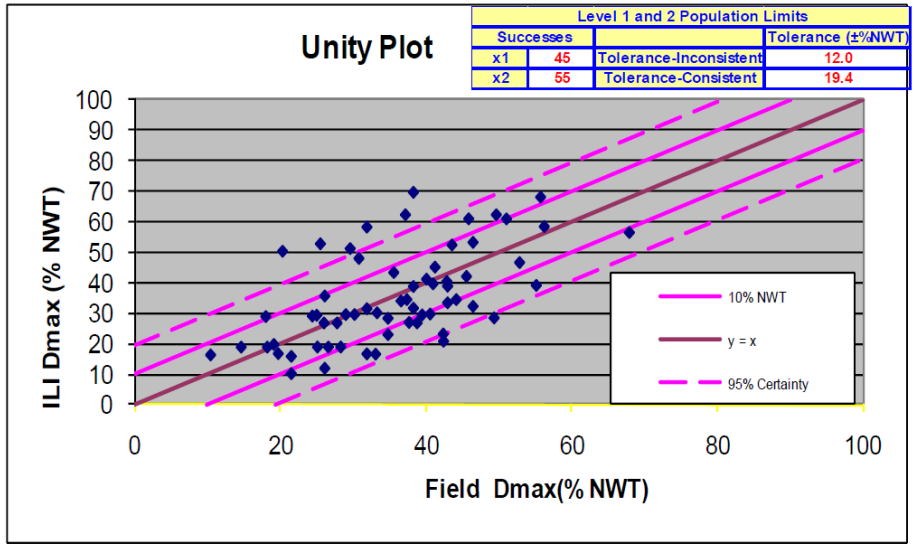


Figure 5: Unity Plot of Re-grade and validations of ILI , n=63

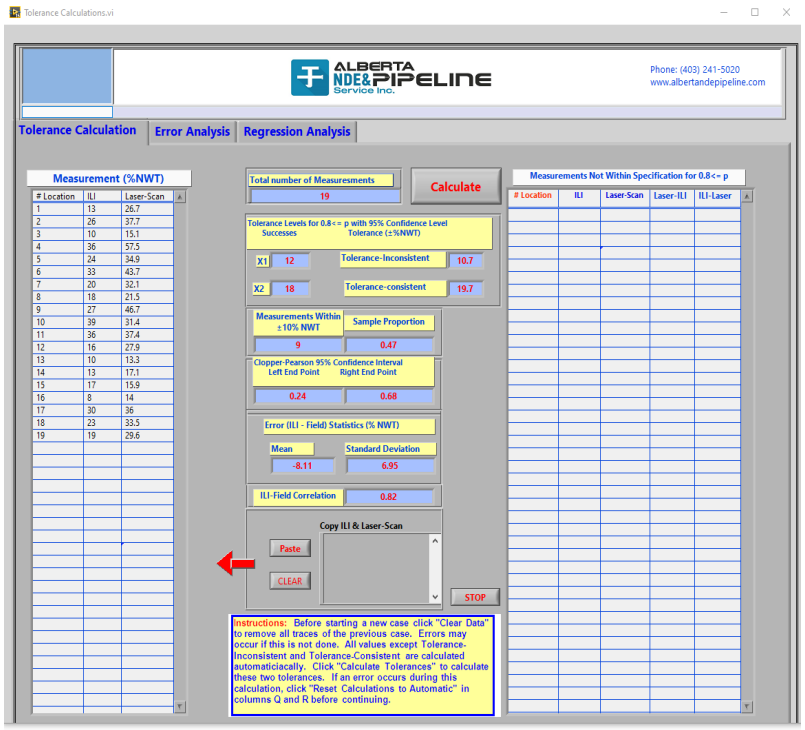


Figure 6: Unity Plot / Tolerance Tool

In-Ditch Measurement Error and True Error

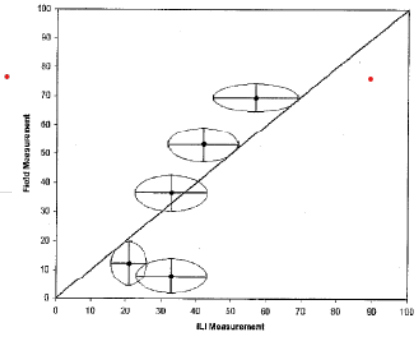
$$\begin{aligned} \text{error}_{ILI} &= (D/t)_{ILI} - (D/t)_{actual} \\ &= [(D/t)_{ILI} - (D/t)_{Field}] + [(D/t)_{Field} - (D/t)_{Actual}] \\ &= [(D/t)_{ILI} - (D/t)_{Field}] + \text{error}_{Field} \end{aligned}$$

This equation shows why it is important to minimize the error in field measurement and matching error.

- With nil NDE error (< 3%wt), observed performance is TRUE ILI error
- No Correction Needed

	Apparent Observed Validation Limit			
+/- tol. P=0.8	In-Ditch Error			
True ILI	10	5	3	1.2
9	13.5	10.3	9.5	9.1
10	14.1	11.2	10.4	10.1
12	15.6	13.0	12.4	12.0
14	17.2	14.9	14.3	14.0

* IPC2010-31269 ILI Performance III Effect of In-ditch Errors



Set $Z = (D/t)_{ILI} - (D/t)_{Field}$ so that

$$\text{error}_{ILI} = Z + \text{error}_{Field}$$

$$Z = \text{error}_{ILI} - \text{error}_{Field}$$

ENGINEERING ANALYSIS SUPPORT

Pipeline Stress Analysis

- Excess thermal movement or settlement of pipeline
- Analysis and field consultation assured proper remediation

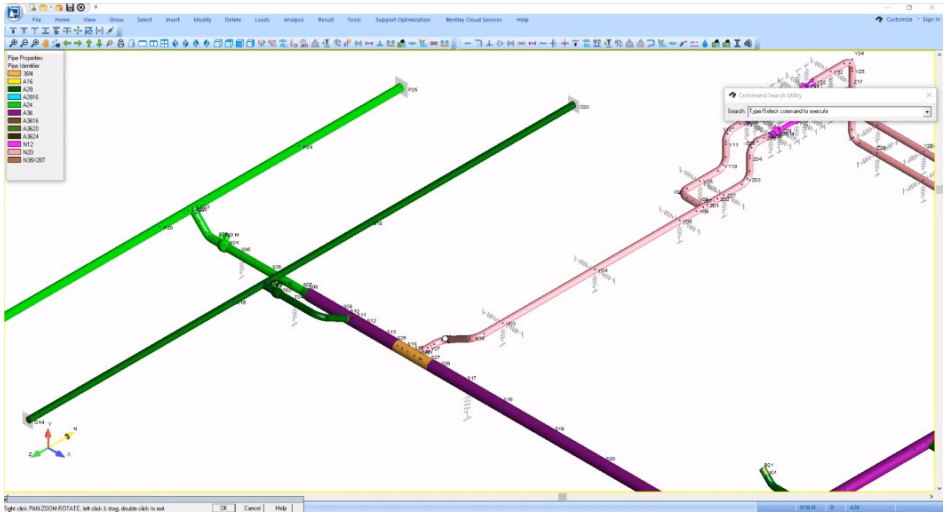


Figure 7: Stress Analysis for Station Yard settlement

Regulatory Compliance And Special Permits

Response to regulatory Corrective Action Order.

- Regulatory agency imposes operating constraints after the incident.
- **ANP** provides strategies and technical support demonstrating fitness for service and mitigation of risk.

Real-time Pipeline Stress Monitoring

- Live load monitoring.
- Strain monitoring for soil movement

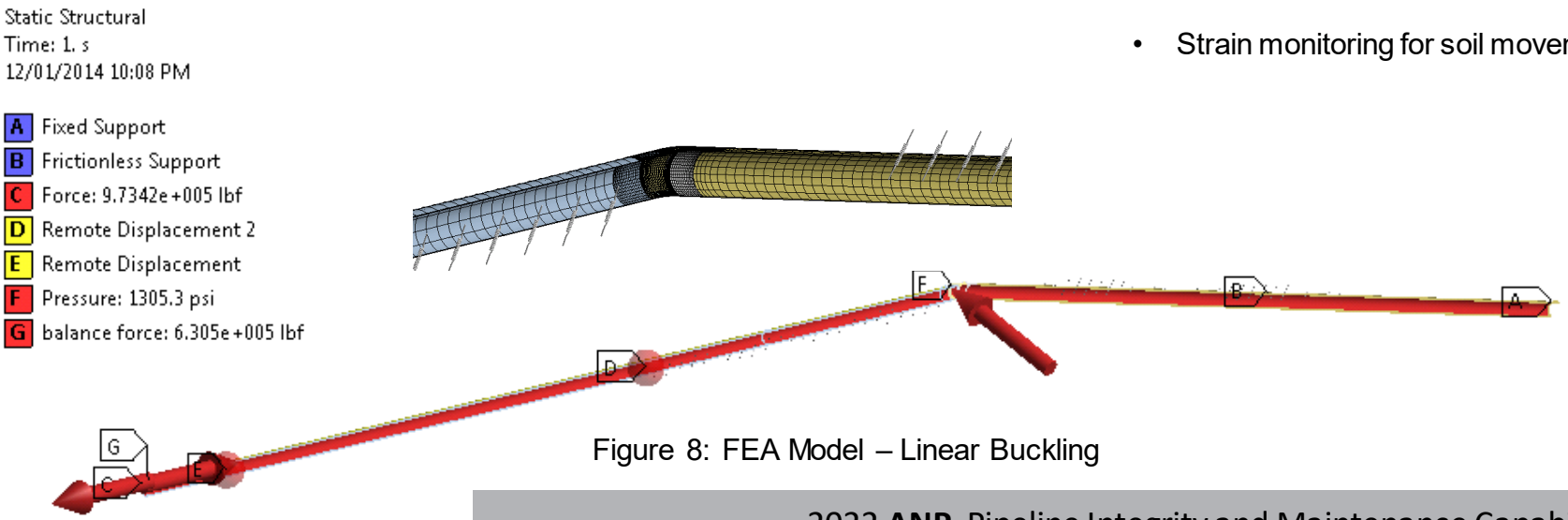


Figure 8: FEA Model – Linear Buckling

GIRTH WELD ANOMALIES

Engineering Critical Assessment

Based on API 579, API 1104/A, or CSA Z662/J-K, our ECA is covering:

- Vintage welds in seismic zone
- Welds with SCC in unstable soil

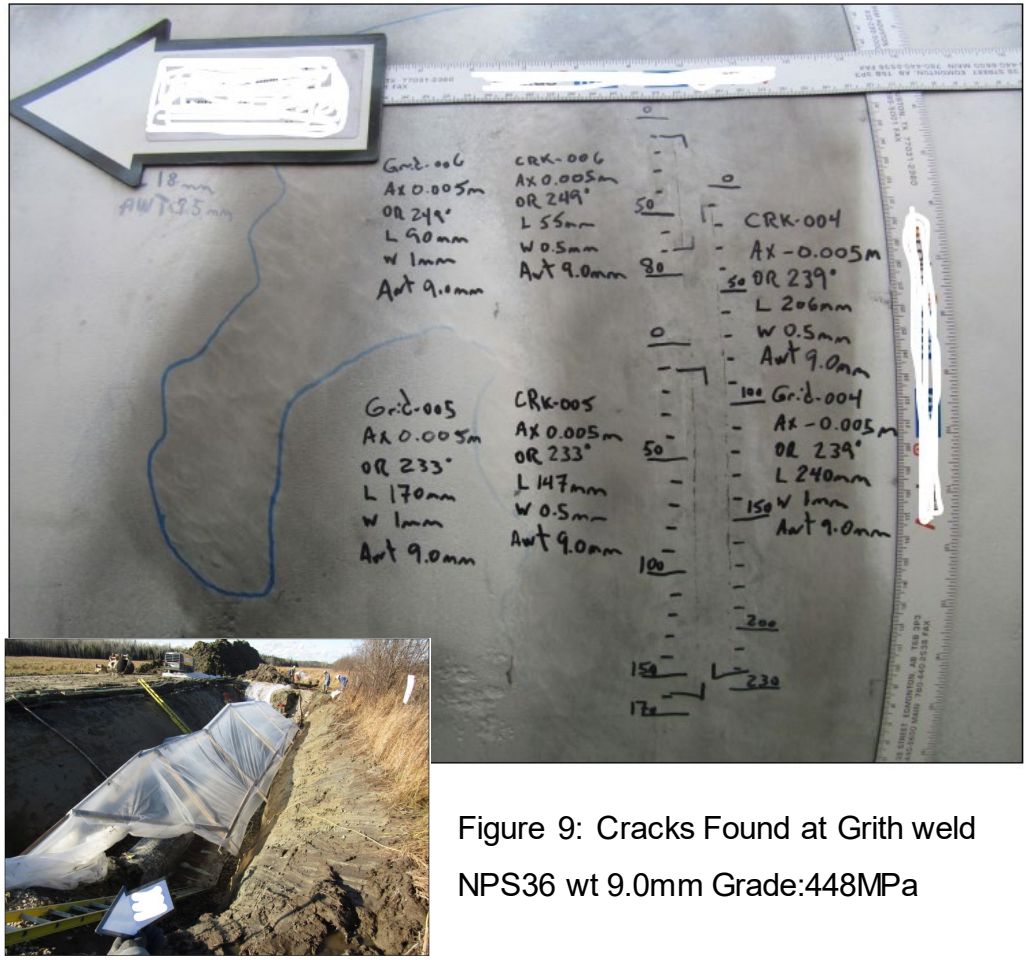


Figure 9: Cracks Found at Grith weld NPS36 wt 9.0mm Grade:448MPa

General Girth Weld Concerns

- Little is known about weld properties
  - Welding procedure, inspection, variability, etc.
  - Only three All-Weld-Metal tensile tests (yield strength)
  - Some very low Charpy results (generally want 40J average, 27J minimum)
- Inspection might not properly characterize flaw size
  - Potential undersizing
- Uncertainty in stress analysis
  - Winter vs. summer construction
  - Did pipe match ditch profile
  - Prior accumulated strain

Girth Weld Repair

- Be ready to sleeve if cracks are found
- Cut out

SUPPORT FIELD INSPECTION OF PIPELINE ANOMALIES AND REMEDIATION

- **24/7 support for field inspection and remediation** ---More than 15 years of expertise on final repair decisions for as found feature
  - Assessment Tool for field inspection of pipeline anomalies
  - ILI feature correlation, often in conjunction with NDT personnel

Figure 10: Field laser Scanning Corrosion feature

24/7 SUPPORT IN-SERVICE PIPELINE INSPECTION

We provide safe excavation pressure for any planning integrity inspection without interrupting or stopping pipeline workflow. We have implemented safe excavation pressure assessment for more than a hundred integrity digs, especially for SCC or corrosion ILI features. Our specialized expertise from on site will help you reduce the overall costs of excavation and inspection.

SUMMARY

The key areas we provide support:

- In-line inspection data interpretation and validation
- Statistical analysis of ILI data (Unity Plot)
- Regulatory compliance and special permits
- 24/7 support field inspection of pipeline anomalies and remediation
- Engineering critical assessment for girth weld anomalies
- Pipeline stress analysis / Real-time pipeline stress monitoring