

Case Study Overview: ILI Data Analysis and Corrosion Management KPIs Revision

Objective

A major energy operator conducted in-line inspections (ILI) on a 30 km carbon steel subsea production flowline. The first ILI was a baseline pre-service and the recent ILI did not report any evidence of internal corrosion, this being in contrast to expectations.

The operator engaged with Imrandd to carry out detailed statistical analysis of the ILI data to identify wall loss associated with internal corrosion, to assess corrosion behaviour over the length of the line and to review and update as appropriate the corrosion management KPIs.

Scope of Work

The project involved statistical analysis of the ILI data, identifying internal wall loss, and analysing corrosion management KPIs in the context of the ILI findings. Imrandd was tasked with quantifying the historical accumulation of corrosion in the line and estimating corrosion rates during the different phases of historical operation. These were compared to the existing corrosion models and discrepancies identified. A detailed analysis of the corrosion management KPIs was also performed to identify critical KPIs for pipeline health and provide recommendations for future KPI usage.

Data Analysis

The analysis steps included:

- **Data Preparation:** Extraction of wall thickness and caliper data from the raw data files provided (measurements from the ART tools available at increments of less than 10 mm x 10 mm for the full length of the line). Application of statistical methods for identification of spurious measurements and alignment of data of each spool for comparison.
- **Assessment of ILI tool inspection performance metrics.** Identification of wall thickness and wall loss measurement performance based on the data provided.
- **Statistical analysis to identify and quantify corrosion growth:** The analysis included two elements: (i) Comparison of wall thickness distributions for the two ILI runs. (ii) Segmentation of spools into blocks and comparison on block minima for each of the two runs.

- **Compensation for measurement error effects:** Applied statistical corrections to address systematic and random measurement errors, enabling reliable identification of sub-millimetre changes in wall thickness and corrosion depth, along with estimates of error in the results.
- **Wall Loss Identification:** Maximum wall loss per spool along the line determined to highlight variation in accumulated corrosion over the length of the line. Analysis of corrosion maps to identify characteristics of wall loss.
- **Future Wall Loss Estimation:** Estimated future corrosion growth based on the operating conditions and findings of the ILI analysis.

Results

The ability of the analysis approach to identify and quantify corrosion at lower levels than the standard ILI reporting criteria provided substantial insights into actual corrosion behaviour. This highlighted differences to the existing corrosion model predictions and provided a strong evidential basis for updates to the Corrosion Management KPIs.

The results also showed that subsea corrosion monitoring spools provided limited insights, and certain KPIs did not accurately reflect cumulative wall loss, which may have skewed corrosion risk perception.

Value

The process of ensuring data integrity and accuracy coupled with detailed statistical analysis, provide the operator with much greater confidence for identifying corrosion characteristics and understanding the current condition of the pipeline, whilst providing valuable insights for future operations. Additionally, refining KPIs allowed for better alignment with actual pipeline conditions, and in turn improved corrosion and integrity management. Imrandd confirmed the need for corrosion inhibitor adjustments and recommended new cumulative risk KPIs to inform long-term decisions.

The work provided greater confidence in knowledge of actual corrosion conditions and provided a basis for optimisation of the approach to Corrosion Management over the remaining life of the pipeline, thereby safeguarding pipeline integrity.