



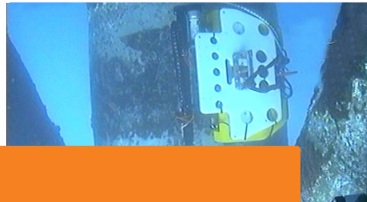
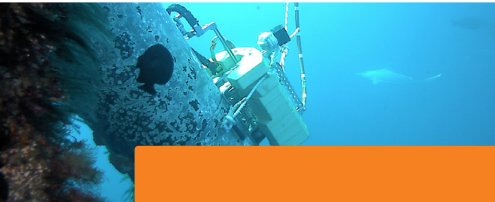
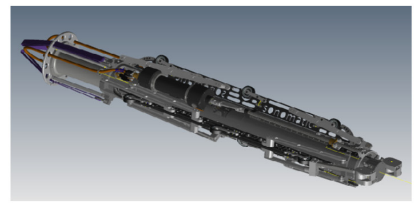
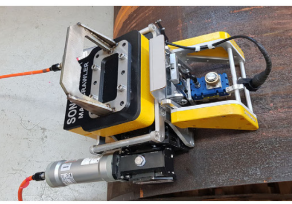
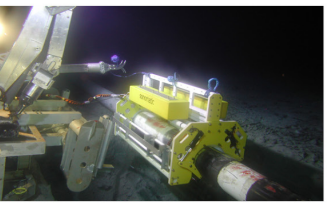
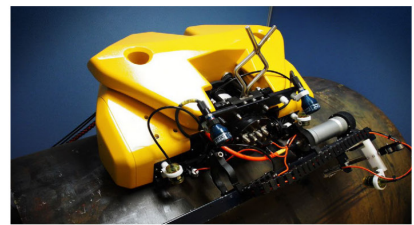
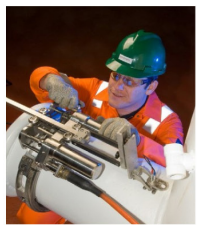
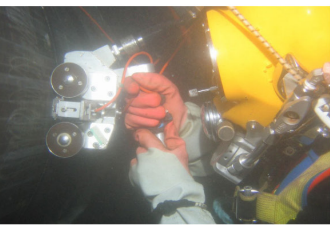
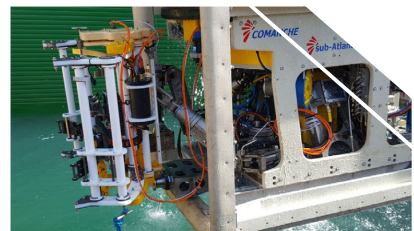
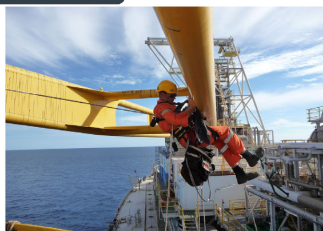
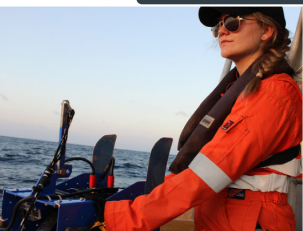
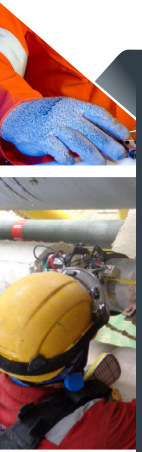
SONOMATIC

DATA SHEET

STATISTICAL ANALYSIS OF SAMPLING INSPECTIONS

THE PURPOSE

This document is composed to assist our clients and the supply chain with a high-level understanding of the benefits and services associated with our statistical analysis of sampling inspections.



STATISTICAL ANALYSIS OF SAMPLING INSPECTIONS

Sampling inspection approaches are of growing interest to pressure system operators since they provide a cost effective means of assessing and validating equipment condition. The approaches rely on inspection of sampling areas on the item of interest and statistical analysis of the data obtained to make estimates for the condition in the uninspected area.

The success of sampling inspection depends on the details of the inspection strategy adopted, the accuracy of the measurement data provided by the inspection and application of appropriate methods of statistical analysis. Strong interaction between the inspection and analysis elements is essential.

Sonomatic has extensive experience in planning, implementation and analysis of sampling inspections and has a track record of successful delivery across a wide range of applications. We work with clients to develop the most efficient strategies and to maximise the value of inspection data obtained.



SAMPLING INSPECTION APPLICATIONS

Sampling inspections are used in a wide range of situations, Some typical applications are covered below:

Non-Intrusive-Inspection (NII) of Pressure Vessels

Sampling inspection and statistical analysis is central to the approach for pressure vessels where a Type B strategy, as per the HOIS NII recommended practice (HOIS-RP-103), applies. In the Type B approach, the coverage would typically be in the range of 20%-50% and the condition of the uninspected area is estimated based on the data collected.

Statistical methods are also applicable to Type A inspections where the aim is to validate absence of degradation based on a small sample coverage.

Pipework

Integrity management of process pipework typically relies on relatively low coverage sample inspection. Statistical analysis of pipework data can provide valuable insights into corrosion behaviour and incorporating the analysis into the inspection planning process will lead to more efficient inspection campaigns.

Unpiggable Pipelines

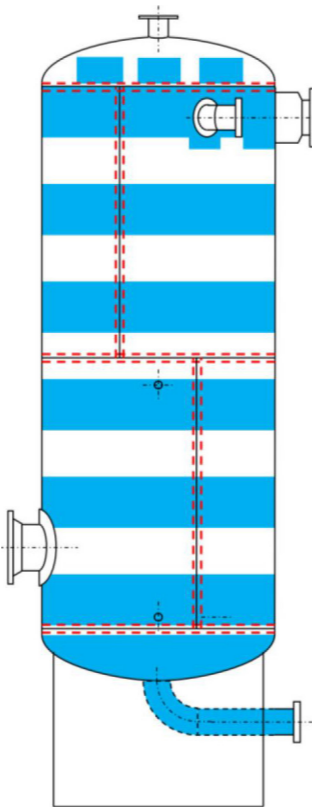
Targeted sample inspections can be evaluated, where degradation is expected to be absent, using Bayesian statistical methods to refine the probability of degradation being absent. Sampling approaches can also be used in situations where degradation is known or expected, with the data for the sample regions being used to estimate the worst case overall.

Restricted Access

There are situations in which access to certain areas is not possible. Calculations for the condition of these areas can be made by extrapolating the data provided inspection can be performed on regions for which the corrosion conditions are expected to be similar.

Integrity Assessment

Analysis of sample inspection data is used as input to probabilistic integrity assessments that consider the potential for failure of the uninspected regions.



PLANNING

Planning is a key element to effective sampling inspections. This is a multi-disciplinary activity, requiring an understanding of corrosion, inspection and statistical analysis. Sonomatic can assist with the following:

- ✔ Corrosion risk assessments.
- ✔ Defining inspection techniques.
- ✔ Analysis of historical inspection data.
- ✔ Defining inspection coverage and locations for inspection.
- ✔ Defining the inspection performance requirements.
- ✔ Defining inspection intervals.

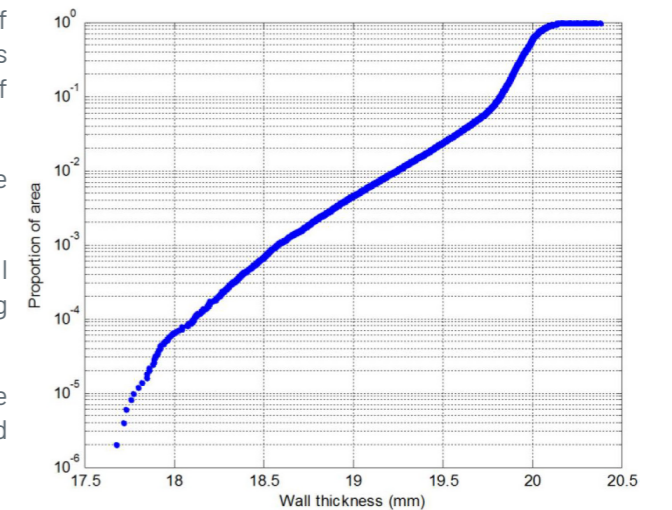
INSPECTION

Sonomatic regularly carries out sampling inspections where the data is used in statistical analysis. The emphasis is on accurate measurement data with quantified performance. The primary techniques used for sampling inspections are 0 degree corrosion mapping and TOFD screening. These inspections are performed using Sonomatic's Microplus ultrasonic systems and bespoke scanners. The raw signal data is stored in full for subsequent analysis of the reliability of each measurement made.

ANALYSIS

Sonomatic is the leading provider of statistical analysis of inspection data to clients in the Oil & Gas and Process industries. We regularly provide analysis in support of sampling inspection strategies, covering the following:

- ✔ Estimates for uninspected areas based on Extreme Value Analysis.
- ✔ Estimates for uninspected areas based on wall thickness distribution analysis of corrosion mapping data.
- ✔ Validation that inspection performance and coverage meet requirements, i.e. is the inspection achieved sufficient to make a case of continued operation.



Sonomatic staff authored the HOIS Recommended Practice for Statistical Analysis of Inspection Data and we provide analysis in accordance with Levels 1,2 and 3 of the RP. While we deliver routine analysis in many cases we continue to focus on innovative new developments, working to develop analysis methods that maximise the value inspection provides to integrity management and to enhance the cost effectiveness of inspections.

SUMMARY

Sonomatic's in depth knowledge and capabilities in both inspection and statistical analysis are fundamental to our approach to sampling inspections. Our methods have a track record of practical implementation and proven to deliver reliable and cost effective information on which to base integrity decisions.

QA AND HS&E

Sonomatic operate under an integrated QHSE management system and are committed to the highest quality and safety of service provision | ISO 9001: 2015: 00007140 | ISO 14001:2015:00037371 | ISO 45001:2018:00037372 | ISO 17020: 2012: 4276 | Achilles FPAL Verified: 076712 | SEQual 1988 | British Safety Council Member: S0388440 |



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