

Statistical analysis of sampling inspections

Sampling inspection approaches are of growing interest to pressure systems 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.



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Sonomatic has offices in strategic global locations so we can respond quickly to customers' requirements wherever they may be situated. Our high quality products are matched only by our customer service. In addition to our field services, we offer training and consultancy at our sites in the UK or at clients' premises anywhere in the world. Sonomatic is committed to improving asset performance through applied and innovative technology; to delivering these benefits to our customers in the products and services that we provide; and to working with our customers, as value-added partners, to realise the maximum benefits of inspection technology.

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 guidelines (DNV-RP-G103), 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. There are benefits to more detailed statistical analysis of the data, e.g. for more efficient prioritisation of inspection.

Unpiggable Pipelines

- Targeted sample inspections are used on dry gas lines to validate the condition of the line as a whole based on Bayesian statistical methods. 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. Estimates for the condition of these areas can be made 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
- Analysis of historical inspection data
- Defining the inspection performance requirements
- Defining inspection techniques
- Defining inspection coverage and locations for inspection
- Defining inspection intervals

Analysis

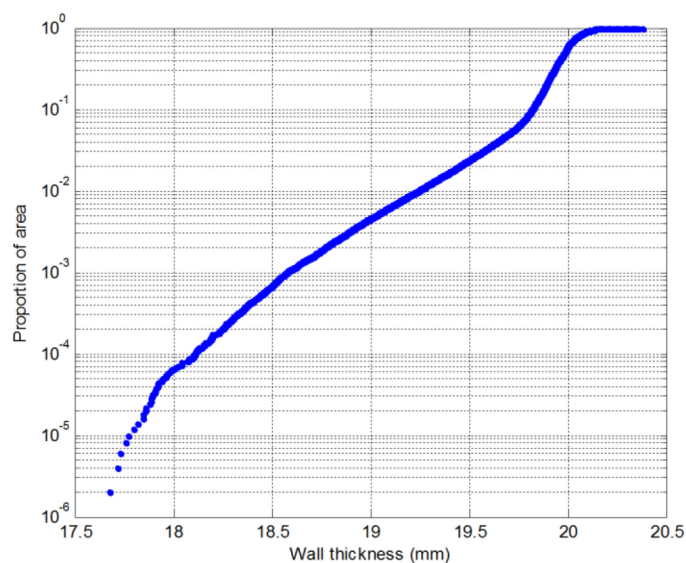
Sonomatic is the leading provider of statistical analysis of inspection data to clients in the Oil & Gas and Process industries. We regularly provide analysis in support of sampling inspection strategies, covering the following.

- 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.

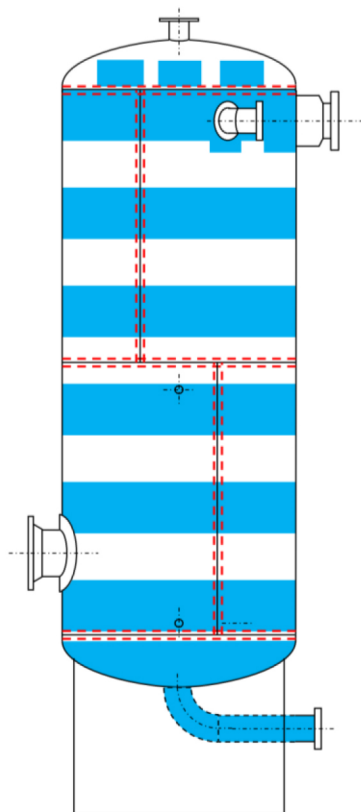
Inspection

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.



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

It is Sonomatic's ongoing commitment to supply services and products, through the application of technical and engineering excellence, which complement both the customer's and our own QA and HS&E requirements.

Sonomatic's commitment to quality is maintained through continuous assessment and review of our Quality Management Systems to BS EN ISO 9001:2008. Sonomatic actively promotes the development, implementation and improvement of our QMS as a part of our ongoing drive to enhance customer satisfaction by meeting or exceeding customer requirements. In 2009 Sonomatic achieved UKAS accreditation as an Inspection Body to BS EN ISO/IEC 17020 (UKAS IB4276).