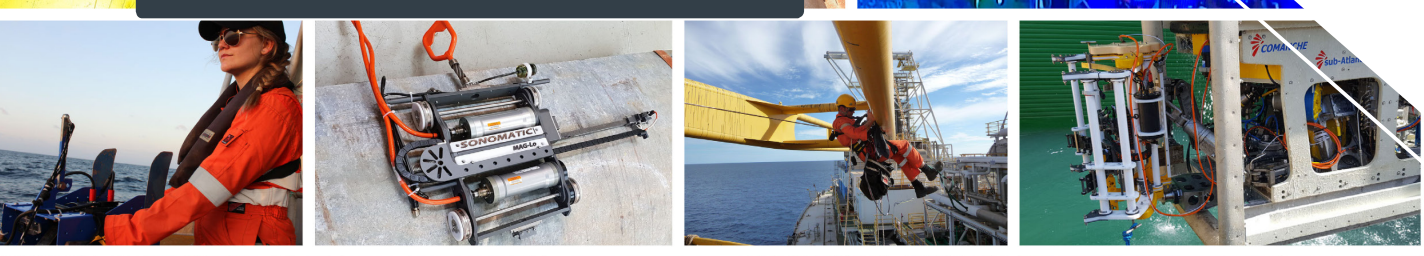
DATA SHEET

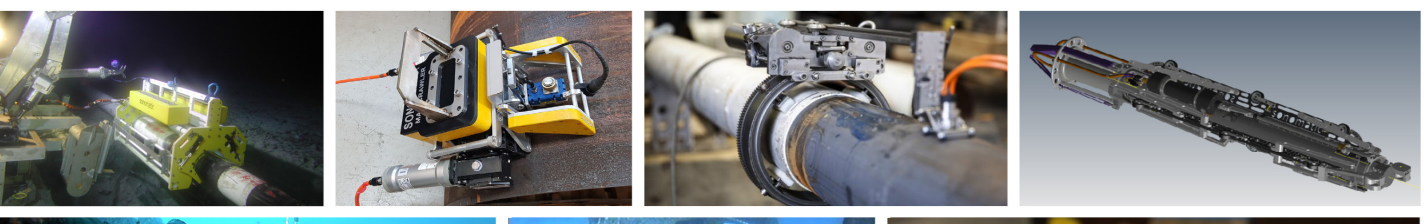
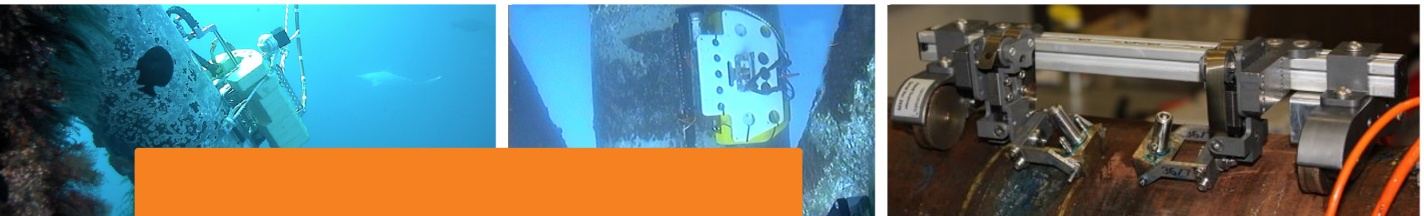
STATISTICAL ANALYSIS IN SUPPORT OF INTEGRITY MANAGEMENT ACTIVITIES

SONOMATIC

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 in support of integrity management activities.



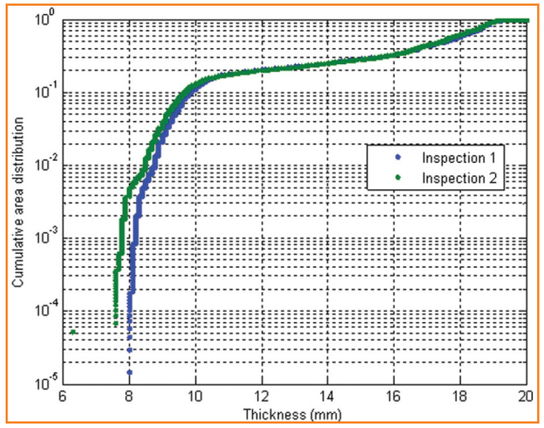



STATISTICAL ANALYSIS IN SUPPORT OF INTEGRITY MANAGEMENT ACTIVITIES

Integriy management of pressure equipment relies on an understanding of the condition of the equipment. Inspection plays a major role in providing the necessary information and in many instances a significant amount of data will be generated over the life of an equipment item. This represents a valuble resource for input to effective integrity management but it is often the case that it is not fully utilised. There are a range of statistical analysis approaches that can assist in enhancing the value of data available and the results can form valuble input to a variety of integrity management decision making processes. Sonomatic offers a number of these approaches, as outlined in this document.

ANALYSIS OF WALL THICKNESS DATA FOR PIPEWORK

Inspection of pipework often involves taking point well thickness measurements or recording the minimum value measured in a scan over a specified area. When several sets of inspection data are available, it is possible to use the data to identify trends, i.e. to estimate corrosion rates in different regions. The nature of typical ultrasonic wall thickness measurements, paticularly with respect to accuray and repeatability, demands that a specific approach should be used in the analysis of the data to maximise its value.



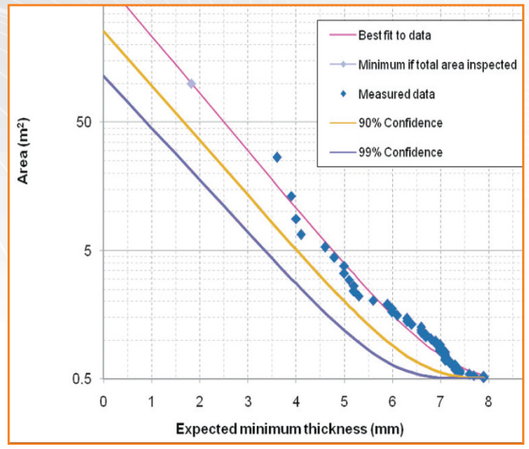
Our approach considers the variability in the measurements and the nature of the techniques employed to estimate confidence limits for projections made using historical data. The value of the data is also enhanced by correlations with areas identified as subject to similar conditions. This type of analysis is paticularly valuble as input to decisions on inspection intervals, e.g. does the current interval provide the required level of assurance? Can the interval justifiably be extended, or should the interval be reduced?

EXTREME VALUE ANALYSIS TO ASSESS COVERAGE REQUIREMENTS

Many systems are subject to inspection that has less than 100% coverage. This is often approached on the basis that areas for inspection are selected so that their condition will be representative (or worse than) the conditions of the regions not inspected. It is, however, often difficult to justify, on a quantified basis, that the coverage applied is sufficient to provide the required level of assurance. Statistical analysis of the data measured offers a solution to this problem.

Our approach is to carry out an extreme value statistical analysis of the measured data to estimate probabilities for the minimum thickness in the regions not inspected. The coverage directly impacts on these probabilities and the associate confidence levels. Hence the statistical analysis forms a basis of assessing whether the coverage applied is sufficient to demonstrate the desired level of assurance.

We have significant experience in using this approach for the analysis of wall thickness data from vessels, both as a means of supporting non-intrusive inspection programmes in place of internal visual inspection and as input to fitness for service assessments. The approach has also been applied to pipework, as a means of assessing if sufficient inspection has been carried out. It has proven valuble in identifying differences between lines, i.e. which areas demand greater attention relative to others.



BAYESIAN UPDATING FOR INSPECTION PLANNING

Bayesian statistics provide a means of best estimating probabilities on the basis of limited information. Bayesian updating refers to methods used for revising the estimates as new information becomes available. Hence Bayesian approaches provide a framework for moving from the general, i.e. what would the average expectation be in a situation about which limited information is available, to the specific, i.e. what is the expectation when additional information specific to the case under consideration is available. This has numerous applications in integrity management but is particularly useful as a means of assessing the effects of inspection on the level of assurance. A view on the probability of degradation (of different extents) being present can be arrived at prior to an inspection being carried out on an equipment item. The accuracy of this will depend on how much is known about the operating conditions and the history of the equipment. This estimate will influence the inspection performance requirement (i.e. the probability of detection and coverage) and hence act as useful input to inspection planning. The results of the inspection (and knowledge of the inspection performance perameters) provide input for updating the initial estimate using the Bayesian approach. This forms a quantified basis for the revision of risk rankings, e.g. in an RBI approach, and also allows sensitivity studies to be carried out to assess the impact of different types of inspection on assurance.

We are able to provide assistance in applying the Bayesian approach as a means of enhancing an existing integrity management programme or in developing methodologies for intergration in such programmes.

SUMMARY

We offer a range of statistical analysis methods aimed at enhancing the value of inspection data and providing quantified inputs to assist planning and evaluation. At the same time, we understand the limitations of the methods and only apply them in circumstances where they are appropriate. If you are interested in assessing whether these mehtods may be of value in your application, please contact one of our worldwide offices.

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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