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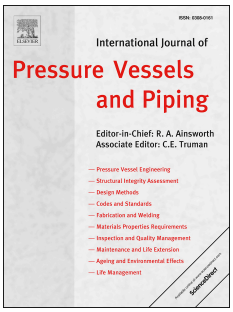

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A Fuzzy Logic-Possibilistic Methodology for Risk-Based Inspection (RBI) Planning of Oil and Gas Piping Subjected to Microbiologically Influenced Corrosion (MIC)

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Abstract

Operating oil and gas installations are continuously subjected to attacks by a number of degrading mechanisms. In order to detect the presence and location of these attacks, installations need to be regularly inspected. Unfortunately, comprehensive inspection programs are quite expensive; hence, Risk-Based Inspection (RBI) methodology is often adopted to assist in the development of effective and efficient inspection programs. In order to account for a particular degradation mechanism in RBI analysis, inspection engineers need to know its likelihood of occurrence and its estimated rate of degradation.

The complex natures of various degradation mechanisms make accurate prediction of the rates of corrosion in an operating plant rather difficult. Luckily, for developing a risk-based inspection (RBI) program, it is not necessary for a model to accurately estimate the degradation process over a wide range of conditions. Instead the requirement is for a practical model which is simple to use, flexible enough to reflect different sections' requirements, and able to incorporate field data.

Microbiologically influenced corrosion (MIC) is one of the commonly encountered degradation mechanisms in offshore and onshore oil and gas installations. As with any other corrosion process, the prediction of likelihood of its initiation and its associated rate of corrosion is difficult to accurately model. A model based on a fuzzy logic framework and possibilistic approach may offer a simple yet flexible tool to assist engineers in developing their RBI programs.

This paper presents a proposed methodology, based on a fuzzy logic framework, for estimating the rate of MIC corrosion in carbon steel static equipment, pipes and pressure vessels. The paper also presents a procedure based on possibility approach to calculating the possibility and necessity of failure. Finally, the paper presents a methodology for determining the optimum time for inspection.

Keywords: MIC, Fuzzy Logic, failure, oil and gas pipes, possibilistic approach, reliability, structural integrity