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A Tracer Application in Detecting Damage to Oil Industry Piping

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Damage to the internal surfaces of piping systems of process industries is caused by continuous exposition to mechanical and chemical processes throughout their life span. This paper reports on a preliminary evaluation as to whether radiotracer techniques can be used in the detection of the two most frequent deterioration processes in an oil production and refining, viz. corrosion and scaling. Usually conventional non-destructive tests, all of which suffer from some some limitation, are used in inspecting the impaired material and equipment. In turn, radiotracers are can be inserted into the flow and afford easy detection and measurement. The question is: the method is sensitive enough? Residence time distribution models that are widely used in fluid flow studies may disclose the conditions inside the investigated system. In this paper both the competence of the tracer technique in identifying which process - corrosion or scale formation - is acting, and of evaluating how much it is interfering with the flow. The tests were performed in pieces of the API 5L-B structural steel, which used in oil refineries. Three test specimens were used: one was flawless (CP-A), in a second one (CP-B) an ad hoc groove had been carved around its inside surface aiming at simulating a corrosion singularity, and in the third one (CP-C) an encircling metallic bulge was welded to its internal surface to simulate a scaling anomaly. Activated manganese sulfate monohydrate (56MnSO4.H2O) in aqueous solution has been as the radioactive tracer. The manganese salt has been irradiated in the CDTN TRIGA reactor facilities. A fluorescent tracer (Rhodamine-WT) has also been tested for comparative purposes. Thr The tests were performed under different flowrate conditions: 0.10, 0.40, and 0.90 m^3/h. The DTSPRO software has been used to analyze the flow residence time distribution curves and the ANSYS CFX 15 fluid dynamics software was used to define the flow in the flow obtained inside test specimens. The results achieved with both radioactive and fluorescent tracers indicated that the presence of the discontinuities in the specimens caused a perturbation in the flow that could be detected by the tracer technique. No deviations relative to a free flow were fount in the CP-A probe, whereas some localized recirculation was detected in the CP-B probe, and stagnation or dead zones was noticed in the CP-C probe. It has been considered that the tracer technique has a potential use in discerning the presence of discontinuities such as corrosion and scale formation in pipes.

Country/Organization invited to participate

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