The Development of a Cost-effective Corrosion Inhibitor for Sour Oil And Gas Carbon Steel Pipelines: From Laboratory Development to Field Success

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Abstract

Objectives/Scope: A major oil and gas operator in western Canada producing and transporting approximately 50,000 BOE per day of sour fluids through carbon steel pipeline was experiencing increased water volumes along with decreased oil production over several years. The higher amounts of water being produced meant an increase in the operator’s incumbent corrosion inhibitor (CI) chemical requirements but with reduced oil production revenues. Thus, a new, more effective corrosion inhibitor was sought by the operator. The scope of the proposed paper is to detail the R&D program, the results obtained from laboratory work along with those gained from a field trial and the outcome of the development of a new cost-effective corrosion inhibitor that was needed to deliver enhanced corrosion mitigation of the carbon steel pipeline infrastructure but at reduced chemical injection dose rates.

Methods, Procedures, Process: In a focused R&D program, corrosion inhibitor (CI) formulation work was conducted using expert knowledge of pertinent chemistries to develop a new candidate CI product. Subsequent corrosion performance tests were conducted on carbon steel electrodes using autoclave vessels under field simulated conditions with synthetic field brine at the field temperature along with the appropriate amounts of carbon dioxide and hydrogen sulfide to assess the newly developed CI. After laboratory work was completed, an extended field trial was carried out in which the efficacy of the new product was assessed using general corrosion rates and pitting analysis before dose rate optimization and comparison versus the incumbent was performed.

Results, Observations, Conclusions: After outperforming the incumbent corrosion inhibitor and verifying physical and secondary properties in the laboratory testing, the extended field trial of the newly developed CI using multiple coupons showed corrosion rates less than 0.02 mm y-1 with no detectable pitting. Field dose rate optimization of the new corrosion inhibitor product facilitated chemical injection rates to be reduced by 40% compared with the incumbent whilst maintaining superior corrosion protection resulting in significant cost savings and associated sustainability benefits for the operator.

Novel/Additive Information: The petroleum industry continues to seek new technologies to enable more efficient production of oil and gas, opportunities to reduce costs, improve the carbon footprint and sustainability of its operations whilst maintaining high levels of safety. The new product development from this R&D program demonstrates that through formulating with new chemistry combinations these key facets can be achieved and new technologies are available to help meet the goals of operators in the industry.