

Determining Corrosion Rates by Electrochemical Techniques in an Industrial Water Cooling System

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This article discusses an evaluation of sulfide corrosion in the water-cooling system of an oil shale plant using a monitoring program that pinpoints the effects of this sulfide contamination in real-time. Several levels of contamination were simulated, and a comparison of mass loss, electrochemical impedance, and linear polarization resistance monitoring techniques was studied. The results confirm that the monitoring technique employed should be selected based on a specialist's analysis because an inappropriate technique had been used previously.

From 1995 to 2000, the industrial water-cooling system of PETROBRAS/SIX (Paraná, Brazil) was contaminated by sulfide, causing a significant increase in corrosion. This led to the premature failure of some of the heat exchange systems and a reduction of the facility's operational readiness. Because of the low sensitivity and slow response time of the gravimetric analysis in use at the time, it was proposed to develop monitoring techniques that would respond to contamination in real-time.

The following goals were established:

- Evaluate and select consolidated electrochemical techniques to verify their sensitivity and response time.
- Define the corrosion evaluation model based on available electrochemical techniques and the gravimetric method, and verify its consistency and applicability using nonlinear models and multivariate statistics.
- Define the system's highest possible tolerance to sulfide.
- Define control variables to characterize the monitoring system and manage corrosion in real-time, allowing for continuous control and reduction of the time required for initiating corrective actions after the onset of sulfide contamination.

Experimental Methodology

DATA COLLECTION

Several levels of contamination and their effects were simulated and a comparison made of the monitoring techniques under study at a corrosion station installed in the water-cooling facility. The purpose was to:

- Simulate various levels of sulfide contamination by injecting gaseous sulfide
- Make a simultaneous evaluation of the techniques and compare them with the gravimetric method
- Simulate conditions of speed,