Solution Note

Honeywell

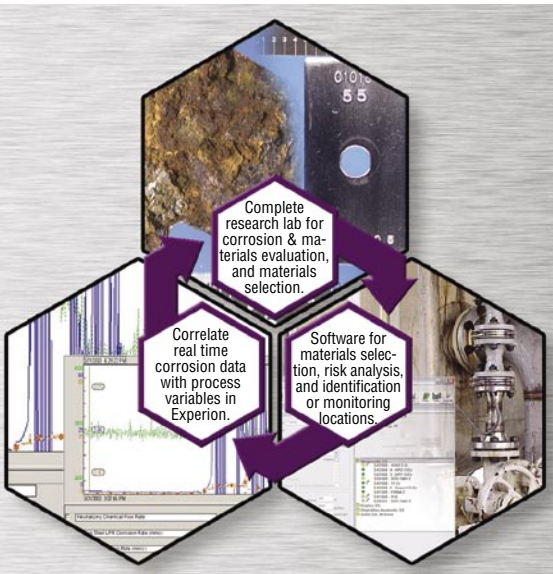
Corrosion Solutions for Cooling Water Systems

Availability of the cooling water system is critical to plant operations. Inadequate control of cooling water can compromise plant operations and increase costs. Detection and control of corrosion and fouling/scaling in cooling water systems can help ensure optimum and reliable plant operations.

Problem: Impact of Cooling Water System Efficiency on Plant Operations

The cooling water system is critical to plant operations. Under inadequate control, the cooling water system can present significant difficulty to the plant in loss of production capacity, increased cost of cleaning and protective chemicals, increased energy and maintenance costs, and a reduction in service life. Although regular checks are made to determine water quality and compliance with prescribed operating conditions, these checks can be infrequent enough to allow corrosion, fouling and scaling to become uncontrollable. This inevitably leads to costly outages that severely affect production. Technology exists that enables a continuous, rapid update of key general and localized (pitting) corrosion, scaling and fouling that can assist the plant operator in real-time to ensure cooling water system availability.

Honeywell offers an integrated approach to corrosion problem solving comprised of Expert Corrosion Services, Systems and Software.



Honeywell Solution

Enabling In-Plant Corrosion Detection and Control: SmartCET® is Honeywell's new corrosion transmitter that embeds proprietary corrosion measuring technology to provide a convenient and efficient method to bring corrosion data to the process control system. Accuracy of the corrosion rate measurement as well as qualification of corrosion mechanism enable time-evolved correlation of process and operational changes. SmartCET can be supplemented by additional measurements including Honeywell's range of analytical products for pH, ORP and conductivity.

Case Study Brief

A cooling water system consisted of four segregated recirculating cooling towers; three of the towers served condensers containing admiralty brass tubes, where the plant had experienced consistently high mild steel corrosion rates (10-20 mpy). The main problem was that corrosion by-products would detach from the mild steel transfer piping in the three units and lead to plugging of the tube sheets. The economic impact was increased back pressure in the condensers, and a subsequent higher heat rate required to overcome this problem.

The project team at the plant initiated a monitoring program using a system incorporating Honeywell's SmartCET technology to identify the cause of the corrosion (Phase I) and designed a solution using chemical treatment (Phase II). Phase I of the program consisted of evaluating the water chemistry and establishing baseline corrosion rates. An archive tube from the condenser was used for the corrosion probe electrodes. The baseline admiralty brass corrosion rates were determined to be around 0.2 mpy under most conditions however spikes as high as 4.0 mpy were recorded for short periods. The corrosion spikes could be directly correlated to the timing of the halogenation chlorine addition introduced to control microbiological activity.

The Phase I conclusion was the new understanding of the impact of halogenation on the increase in corrosion rates. It was determined that copper from the condensers was building up in the cooling water circuit, eventually precipitating and causing galvanic corrosion in the mild steel transfer lines. A mass balance analysis indicated that as much as 30 parts per billion (ppb) of copper could potentially be added to the recirculating water twice per day.

In Phase II, a chemical trial was initiated to introduce tolytriazole (TT) at an active residual level of 0.75 ppm in the recirculating water. Low concentrations of azole will typically form an extremely tenacious protective film on copper alloy surfaces. Following the introduction of the azole treatment, corrosion incidences

Honeywell SmartCET®
Corrosion Transmitter

were still observed at a frequency coincident with the halogenation, although there was a significant reduction in the magnitude of the corrosion rate. SmartCET technology enabled the team to monitor the changes and draw important conclusions: during Phase I, corrosion rates peaked at 4.0 mpy, and took 40-to-60 minutes to return to baseline values. Following the change in chemical treatment, the peaks in corrosion rate were reduced to 1.0 mpy or less, and recovery to baseline values was much quicker, about 10 minutes.

Although increased corrosion activity was still caused by the halogenation, the impact had been greatly reduced and recovery time shortened. Integrating between the data curves "before" and "after" chemical treatment with azole, there was an approximate 85 percent reduction in the amount of copper removed from the condenser with the presence of 0.75 ppm azole in the recirculating water. Mild steel corrosion rates were similarly reduced from a maximum of 20 mpy to below 5.0 mpy. Accordingly, the introduction of tolytriazole feed at 0.75 ppm was sufficient to reduce the mild steel corrosion rate to under the operating goal of 5.0 mpy without changing the facility's established halogenation practices. Honeywell SmartCET technology proved an invaluable tool in helping the project team to define the improvement in corrosion both before and after the chemical trial.

Benefits

Honeywell's innovative solution minimizes the impact of corrosion in cooling water systems across many industrial sectors.

- In the case study, the higher heat rate required to overcome the increased backpressure in the condensers would have an associated increased fuel cost and result in a lower operating efficiency.
- The change in chemical treatment on the plant resulted in a better than 75% reduction of mild steel corrosion.
- Prior to the change in chemical treatment the major impact of shutting down the condensers to remove the fouling was lost production, typically $1.5M loss over three days.
- Significant cost savings can be realized through operating a cooling water system under better control by mitigating corrosion and fouling. Extending the number of cycles of cooling towers at a large plant could save many hundreds of thousands of dollars per year.

Corrosion Prediction, Risk Assessment: A suite of software product offerings, reflecting over 20 years of corrosion expertise derived from laboratory corrosion research, is focused on delivering valuable predictive data for real plant operating circumstances. Plant and consulting engineers find tremendous value in our software products that aid in materials selection, corrosion rate prediction within pipelines and equipment, and analysis of plant asset integrity and risk.

Assessment of Materials for Service Environments: Honeywell's corrosion expertise ranges from lab services for metallurgical corrosion analysis to material consultation with an emphasis on specific plant operating conditions to analysis of a plant's real-time corrosion conditions.

Corrosion Solutions, Design and Implementation: Special data evaluation tools are available to automate the analysis and correlation of real-time corrosion and process data. Supporting corrosion services include the development of advanced process control solutions such as plant integrity optimization and closed loop control. Working together, Honeywell's process control and corrosion experts design and deliver solutions that help to optimize your existing plant operating window while bringing equipment integrity measures within best practices.

More Information

For more information on any of Honeywell's Products, Services, or Solutions, visit our website www.honeywell.com/ps or contact your Honeywell account manager.

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