GE
Water & Process Technologies

Case Study

Continuum AEC* Improves Condenser Flow, Eliminates Need for US$750,000 Retrofit at British Refinery

A large cooling system in a major British refinery was treated with a soluble phosphate program.Typically, results were good, with mild steel corrosion rates of <2 mpy (0.05 mm/y). Makeup is approximately 75% river water that can contain high suspended solids, some phosphate (0.2 to 1.0 ppm [mg/L] PO_4), and 25% well water, with plans to move completely to well water.

System Description

- Volume: 1.6 million gallons (6,000 m^3)
- Evaporation: 352 gpm (80 m^3/h)
- Cycles: 1.5 to 2.0 (System hydraulics limit cycles)
- Blowdown: 352 to 440 gpm (80 to 100 m^3/h)
- System half life: 1.5 to 1.7 days
- Condenser (normal skin temp.): 122 to 131°F (50 to 55°C)

(Condenser max. outlet temp. observed: 122 to 131°F (50 to 55°C). Condenser max. skin temp. estimated from max. outlet: 132 to141°F (56 to 61°C).

Recirculating Water Chemistry

- Calcium hardness: 550 to 600 ppm (mg/L) (as $CaCO_3$)
- Alkalinity: 150 to 200 ppm (mg/L) (as $CaCO_3$)
- pH 8.0 to 8.5 (Continuum AEC required no acid for pH control)
- Conductivity: 2,200 to 2,500 mS (mmhos)
- LSI: +1.3 to +1.6

Challenge

A critical condenser on the wet gas compressor (WGC) circuit occasionally suffered from fouling. This was caused by two main effects:

1. Suspended material in the makeup along with low flow in heat exchange equipment created a high demand for dispersant polymer
2. pH control was erratic at times, resulting in pH above the recommended maximum for the soluble phosphate program

When the two effects happened simultaneously, calcium phosphate fouling occurred on the condenser tubes. This reduced condenser output and throughput to the cat cracker, resulting in a lower profit margin for the refinery.

Solution

With the launch of Continuum AEC technology, it was readily apparent that a lower phosphate, higher pH program would be ideal for the system. Lower phosphate decreased the likelihood of forming calcium phosphate; higher operating pH meant less reliance on unreliable acid dosing equipment. Operating personnel, having acid cleaned the WGC at least twice, were very receptive to initiating an AEC-based program.

Results

Mild steel coupons are recording corrosion rates of 1.4 to 1.6 mpy (0.041 mm/y). Corrator readings taken daily for mild steel are 1.7 to 2.2 mpy (0.043 to 0.056 mm/y). Plant people are extremely happy with the results. The treatment was severely tested early in the program. A sticking valve on the WGC

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condenser increased waterside skin temperatures, a condition that normally resulted in calcium phosphate fouling. Outlet temperatures increased to about122 to 131°F (50 to 55°C), but the condenser continued to run well with no decrease in performance.

Prior to the Continuum AEC program, the refinery was about to proceed with a US$750,000 capital project to improve flow to the WGC condenser. Because of the success of Continuum AEC, the project was scrapped. As a result, Continuum AEC technology was proposed (at equal cost to the soluble phosphate program) for all major on-site cooling systems. Recently, GE Water & Process Technologies was awarded a contract to treat all cooling systems in the refinery.