NALCO Water
An Ecolab Company

Louisiana chemical plant minimizes production losses using patented deposit sensor technology to identify and proactively address biofilm deposition

CASE STUDY

BACKGROUND

Chemical manufacturing plants typically contain many nutrients which when leaked into the cooling tower could cause high fouling issues, especially microbial issues. Historically, this Louisiana chemical plant had fouling challenges with process leaks into the cooling tower. The fouling negatively impacted tower performance—a situation that was exacerbated by a lack of direct monitoring tools and data insights.

SITUATION

The Nalco Water technical consultant and onsite experts at this site proposed Nalco Water's 3D TRASAR™ Cooling Water Technology Premium Plus program, a state-of-the-art feed, control and monitoring technology designed to manage a cooling system based on the actual stresses placed upon it. The Premium Plus program consists of a deposit sensor with data contextualized on Nalco Water's digital platform ECOLAB3D™ and monitored 24x7 by remote service experts at the Ecolab Global Intelligence Center (EGIC).

The deposit sensor utilizes an array of eight Resistance Temperature Devices (RTDs) which can be configured to model various temperatures around the cooling system. Because biofilm forms at different temperatures and has different heat transfer characteristics from mineral scale, those insights into the type of fouling help drive appropriate corrective action without having to wait for a deposit analysis or a measured decline in heat exchanger performance.

The deposit sensor reports its data into ECOLAB3D where the data is contextualized along with several other parameters from the 3D TRASAR controller on the tower. Data from the sensor is reported as deposit index on ECOLAB3D; higher values of deposit index indicate higher deposition stress in the system. If reached, the upper specification limit of the deposit index parameter triggers an alarm indicating an action is required to alleviate the stress. Alarms are continuously monitored by the EGIC. This team provides root-cause analysis for the deposition stress and suggests corrective action plans to resolve the stress that can deteriorate asset performance.

RESULTS

The Premium Plus skid was installed at this site at the cooling tower with a history of process leaks and fill damage. The deposit sensor was configured at four different temperatures: bulk water temperature (70 °F), 110 °F, 130 °F and 150 °F.

As the evaluation progressed, the deposit sensor detected two major deposit events. The first event, based on the alarm from the sensor, was identified as mineral scale (figure1). A corrective slug dose of scale dispersant was administered by Nalco Water's onsite expert which effectively recovered the system to its original state (figure 2).

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ANNUAL SAVINGS

ASSET PROTECTION
$10,000
avoided heat exchanger cleaning costs

LOCATION PRODUCTIVITY
$700,000
productivity savings

TOTAL VALUE DELIVERED
$710,000

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RESULTS Continued

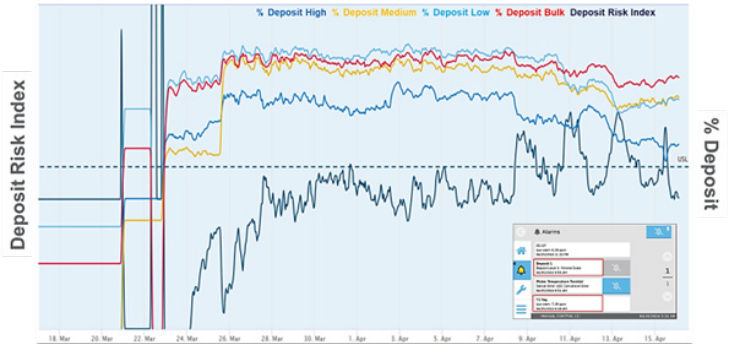


FIGURE 1: Increased deposit risk index and alarm from Premium Plus indicating mineral scale event with low severity.

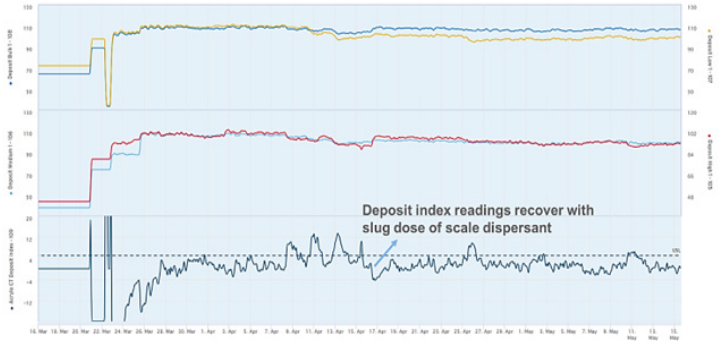


FIGURE 2: Deposit risk index readings recover with slug dose of scale dispersant.

Premium Plus detected a second event which the sensor identified as biofilm deposition (figure 3). Nalco Water's EGIC team investigated further and identified the root cause to be a discrepancy in bleach feed (figure 4). Nalco Water representatives worked closely with the customer to implement bleach feed changes to return the system to normal.

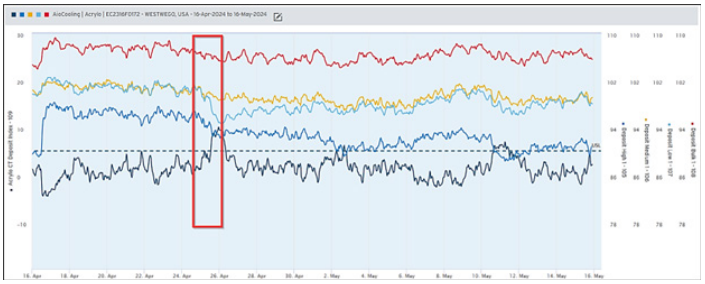
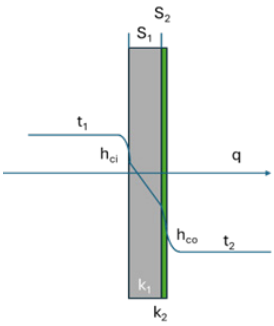


FIGURE 3: High deposit risk index readings from Premium Plus indicate increased deposition stress in the system. Deposit risk index readings recover with correction to bleach feed.

FIGURE 4: On 24-25 April, oxidation-reduction potential (ORP) declined, but the bleach pump relay indicated the pump was running. However, the bleach pump had failed. Once the pump was repaired, ORP increased and the deposit risk index declined, indicating a clean-up of the biofilm.



Where:

- t_1 = water temperature (°F)
- t_2 = process temperature (°F)
- h_{ci} = convective heat transfer coefficient, outside wall (W/m²K)
- h_{co} = convective heat transfer inside wall (W/m²K)
- S_1 = thickness of the tube wall
- S_2 = thickness of biofilm
- K1 = thermal conductivity of the tube wall (W/(mK))
- k_2 = thermal conductivity of biofilm (W/(mK))

FIGURE 5: Biofilm conducts heat 625X less readily than a copper heat exchanger tube. Even a very thin layer of biofilm retards heat transfer enough to affect production rates. In this case, the biofilm layer was estimated to be only 20 microns thick, about the width of a human hair, with an estimated $700,000 in lost production.

CONCLUSION

Deposition stress can negatively impact asset performance. Nalco Water's patented Premium Plus technology enables real-time detection of deposition stress to inform faster, more targeted corrective action plans. For this chemical plant case, Premium Plus has an estimated preventive value of $710,000. While process leaks continue to pose challenges to the plant's efficiency, Premium Plus technology combined with Nalco Water's onsite experts can help lessen impacts to assets and lower operational costs for the plant.

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