CASE STUDY

eROI℠ by Ecolab

Louisiana Power Plant Uses Innovative Nalco Water Technology to Detect Fouling and Maximize Revenue

BACKGROUND

In a deregulated power market, merchant power plants prioritize availability, reliability and efficiency. When power demand (and wholesale prices) increase, these plants can maximize their profitability and provide low-cost, reliable power to their customers.

At this 585 MW coal-fired power plant, changes to their water source threatened to impact plant operations. To address the challenge, the plant engineering staff used an innovative Nalco Water deposit sensing technology to provide a heads-up when scaling risks increased.

SITUATION

Surface waters — rivers, lakes and streams — differ greatly from ground waters sourced from wells in the same geographic area. As an example, river water stream flows are measured in feet/second. A moderate streamflow velocity of 1 ft/second equates to 16 miles per day. What comes from the river today can be very different from what comes from the river tomorrow. Groundwater flowrates are much lower, often as low as 1 foot/year or even 1 foot/decade. In practical terms, ground water sources are much more stable, in terms of water chemistry, than surface waters.

At this plant, although the ground water source was more consistent, it was consistently poor. The new incoming water contained much higher concentrations of iron, manganese and silica, all scale-forming constituents and microbial concentrations which if not controlled or properly treated, would degrade condenser and heat exchanger efficiency.

SOLUTION

Working with their Nalco Water sales engineer, the plant engineering staff developed a plan to address the changes. A new biocide and dispersant program was modeled using the Nalco Water Cooling Water Optimizer. The program also optimized cooling tower cycles of concentration, to minimize water use, and incorporated variability analysis to set the proper specification limits for the program.

Nalco Water's 3D TRASAR™ Cooling Water Technology provided feed, control and communications capabilities to address changes and upsets. It also provided communications and alarming capabilities to keep users informed of system performance.

To address the unique challenges presented by the new water source, the plant chose to utilize Nalco Water's patented deposit sensor (Image 1) to measure and report, in real time, the fouling potential of the recirculating water.

ANNUAL SAVINGS

PRODUCTIVITY

Improved
$3.270M

COSTS

Maintenance and cost
$41,000

TOTAL VALUE DELIVERED

$3.3M

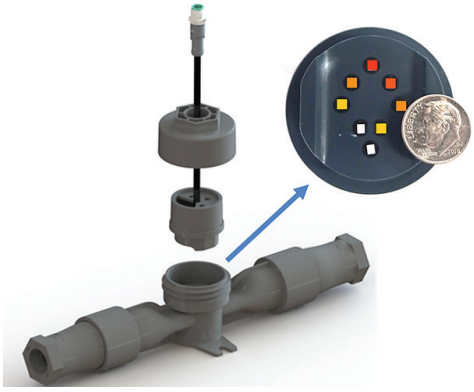

Image 1. The novel deposit sensor contains an array of eight resistant temperature devices (RTDs) that can be set to 4 different temperatures (bulk, low, medium, hot) based on actual heat exchanger skin temps. Using the idea of thermal decay, the deposit sensor can provide an early indication of fouling and also differentiate the type of fouling.

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Mineral scale commonly forms more readily as temperatures increase. Microbial fouling occurs at lower temperatures. The deposit sensor employs an array of eight, individually programmable resistance temperature devices (RTDs) and principles of thermal decay to differentiate between mineral scaling and microbial fouling. The sensor can be programmed to simulate up to four different heat exchanger skin temperatures (bulk, low, medium, hot).

Industry today is awash in data. Industry studies have shown less than 1% of collected data is analyzed. To bridge that gap, data from the deposit monitor, along with water chemistry and treatment data from 3D TRASAR, are sent to the cloud-based digital platform ECOLAB3D™ where it can be contextualized. The raw RTD data quantifies the total deposit stress index of the water. Alarming capabilities provide early warning of deposit potential and identify type of deposit suspected.

RESULTS

Shortly after the deposit sensor was installed, the sensor reported a performance decline. Plant personnel attributed it to suspended solids released into the bulk water by a recent start-up. The sensor was cleaned and returned to service. The sensors reported the rapid deposition event again. (Figure 1).

Figure 1. Plot showing deposit risk index at the power plant from the deposit sensor (higher the deposit risk index, higher the deposition stress). Deposit risk index trends up on 06/02/23 and 06/07/23 indicating increase in deposition stress during this period.

Further investigation revealed several operational and chemical changes as the causes of the deposition. The start-up played a role by increasing the concentration of suspended solids, but the higher iron and silica concentrations in the new make-up water source, combined with poor control of cooling tower cycles of concentration and loss of dispersant feed all combined to cause

Image 2. Due to operational issues, the plant was unable to respond to the early deposit stress warnings. As a result, an iron-silica deposition event occurred which fouled the cooling tower and condenser and forced shutdown for remediation.

the deposition event (Image 2). The data collected, transmitted and analyzed by the Nalco Water team helped the plant engineering staff make good decisions about how this event happened and what could be done to prevent its recurrence. This event was severe enough to cause a plant derate and a chemical cleaning of the condenser during a time of peak power demand. The estimated lost revenue was over $3 million. Subsequent deposit analysis confirmed what the Nalco Water technology had predicted: an iron-silica scale caused by elevated levels of contaminants associated with the recent startup and the new well-water source (Figure 2). The plant incurred a cleaning cost of $41,000 to bring the condenser back to peak efficiency.

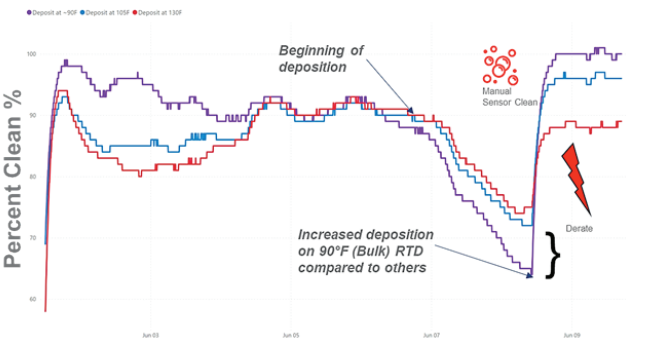

Figure 2. Plot showing raw RTD data with three distinct temperatures (Bulk (90°F), medium (105°F) and hot (130°F)); hot temperature RTD indicating skin temperature of the condenser. Bulk temperature displays the highest decrease in % clean indicating silica deposition (silica has higher propensity to deposit at lower temperatures).

CONCLUSION

Today, engineering staffs are evaluating the financial and operational futures of many older power plants. This plant is scheduled to remain in operation for another five to ten years. To do that, it must perform financially by maintaining high availability, reliability and plant efficiency. Nalco Water's on-site technical expertise, equipped with the most advanced water treatment, monitoring and control technology, will help this plant achieve its financial and operational goals.

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