

Cleaning Program for Rhombic Sulfur deposits in Geothermal Power Plant Increases Electric Power Generation by 3 MW in a 26.8 MW unit



BACKGROUND

Sulfur deposit fouling in the cooling tower fill and the barometric condensers of two geothermal units limited their performance, lowering the electric power generation by more than three Mw per unit. This fouling affected productivity and forced shutdowns of the units.

To address the difficult challenge of sulfur deposit removal, Nalco Water developed a specific cleaning solution, and in doing so, recovered productivity for the customer.

SITUATION

There were operating problems during the commissioning of two geothermal power plants due to the chemical and biological oxidation of sulfides in the geothermal condensate. Serious rhombic sulfur fouling occurred, both in lines and fill of the cooling tower and barometric condensers, causing loss of condenser vacuum and therefore electric power generation losses in both units.

Rhombic sulfur fouling concentration amounted to more than 94%, which is highly difficult to remove online.

The first unit, with initial capacity to produce 26.8 Mw, was producing only ~19.5 Mw. When the unit was taken offline, serious sulfur fouling was found in its condenser fill.

Due to the low solubility of rhombic sulfur and the difficulty in removing it mechanically, it was decided to resort to Nalco Water's experience in crystallized mineral cleaning. By laboratory tests, Nalco Water designed and developed a cleaning solution composed of emollients, wetting agents, solubilizers and highpowerful complexing agents.

FINANCIAL / SOCIAL IMPACT

980,000 USD /year per unit in costs avoided during de-rate



CUSTOMER IMPACT



24480 MW/year in increased electric power generation per unit

SOLUTION

The sulfur deposits were eliminated by solubilizing their supporting salts and breaking down the sulfur macro crystals, using a highly alkaline solution developed by Nalco Water. This solution, which contained a high concentration of caustic soda and caustic potash enriched with emollients, wetting agents and caustic inhibitors, was used in a chemical cleaning program at high-temperature conditions (above 60o C), that recirculated the solution through the barometric condenser.

Employing all necessary safety measures, and leveraging extensive Nalco Water experience in chemical cleanings, the customer and their contractor effectively removed 98% of the rhombic sulfur deposits in the condenser—recovering the unit’s capacity.



Image 1 - Barometric condenser fill, before and after chemical cleaning

As a result of the chemical cleaning program recommended and advised by Nalco Water, the unit reported a three-Mw/Hr increase in electric power generation per unit once placed back in operation.

Likewise, in a joint operation of the geothermal power plant, the vacuum pumps were cleaned and repaired, and the cooling tower film type fill was changed to a hybrid type fill. This enabled the power plant to bring the unit up to nearly 27-Mw of generation, thus eliminating the derating completely.

This process was replicated for the second unit with similar results.

CONCLUSION

Nalco Water’s knowledge and experience in the geothermal industry enabled a geothermal power plant to recover Unit Mw/Hr Electric Power Generating capacity (which was out of line), thus obtaining great economic impact, operational reliability, equipment (asset) protection, improved safety and environmental preservation.

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