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Solenis Controls Silica and Calcium Carbonate Deposition at Geothermal Power Plant

Ameroyal™ 710 antiscalant

Customer Overview:

- Segment: Power Generation Geothermal
- Location: Southwest, USA

Application Overview:

- Type: Process Antiscalants
- Equipment: Production wells located on naturally occurring geothermal reservoirs supply a mixture of hot (300 °F) brine to a series of three flash evaporators and the steam is used to drive turbogenerators for electricity. Cooler brine which can no longer flash to steam is introduced to a binary unit where the heat is used to flash isopentane. The flashed isopentane is used to drive a turbine for electrical generation.
- Capacity: 8,000,000 pound per hour of brine generating 40 MW of electricity.
- Other: The brine from the production wells has a temperature of 300 °F and 170 °F after the binary units prior to re-injection. The pH increases from 6.8 to 9.4 as non-condensable gases flash.

Prior Treatment:

The competitive antiscalant program utilized a two product approach with a CaCO₃ inhibitor fed at inlet to the flash evaporators and a silica inhibitor fed at the inlet to the binary unit.

Problem Summary:

The competitive treatment program was ineffective and the plant had to shut down three times per year to perform hydrofluoric acid cleanings. Not only were treatment costs and chemical cleaning costs exceeding \$1,500,000 annually but also posed a serious worker exposure concern.

The deposition is caused when the brine is flashed across the evaporators and becomes concentrated creating high silica and calcium carbonate deposition.

As the hot brine travels through the evaporators, the temperature drops from 300 °F at the plant inlet to 170 °F at the re-injection header and the pH increases from 6.8 to 9.4. This poses a dual problem in that higher pH values promote calcium carbonate scaling while the lower temperatures promote silica formation. A treatment regime that addressed both conditions was needed in order to satisfy the customer.

Customer Objectives:

- Reduce brine scaling potential
- Minimize plant shut downs
- Eliminate personnel exposure to hydrofluoric acid
- Optimized MW production
- Improve brine treatment costs

Solenis Solution:

Solenis proposed the application of Ameroyal 710 antiscalant which is a proprietary blend designed to control calcium carbonate scale but more importantly, silica deposition. The product functions by crystal lattice distortion, threshold inhibition, sequestration and dispersion. These mechanisms reduce the potential for calcium carbonate scale formation and inhibit the agglomeration as well as the actual polymerization of the monomeric silica. The application of this product at nearly half the feed rate of the competitive program dramatically reduced the amount of silica and CaCO₃ scale.

Customer Benefits:

- Reduced plant shut downs for scale cleaning
- Customer realized over \$500,000 annual savings
- Improved worker safety and minimized health risks
- Allowed for improved electricity production.
- Reduced brine scaling potential
- Weekly service and analytical data have shown significant control of calcium and silica deposition.

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Conclusion:

The Solenis program has proven very effective in managing the scaling potential of the brine. Scaling rates on average have been less than 0.1 inches/year.

Figure 1 shows a retractable coupon after being exposed to Ameroyal 710 treatment.

Effective scale control has been maintained with a single product and dramatically lower feed rate. According to the customer “the Ameroyal 710 had established a new baseline for antiscalant performance.”

The graph below is a comparison of the scaling rates with previous program versus Ameroyal 710.



Figure 1: Coupon exposed to Ameroyal 710 Treatment.

**GEOHERMAL PLANT PROCESS
SCALING RATE COMPARISON**

