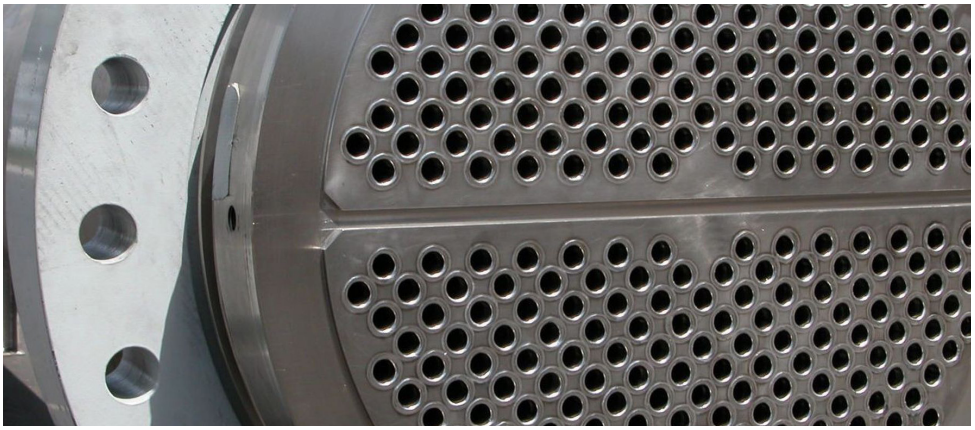
CASE STUDY

eROI℠ by Ecolab

Silica & Silicate Inhibitor Program for 2-Phase Header Helps Geothermal Power Plant Protect Asset & Reliability



ANNUAL SAVINGS

PRODUCTIVITY

Reduced shutdown days by 50%

$1,000,000

COSTS

Reduced cleaning to once/year

$100,000

TOTAL VALUE DELIVERED

$1,100,000

BACKGROUND

As geothermal power has accelerated globally, there has been a focus on how to increase production, efficiency, and reliability of these operations. Countries rich in geothermal resources are eager to shift to this renewable resource, however, geothermal power production is not without its challenges. Namely, this method of power generation must control scale formation to maintain reliability and affordability. Scale formation itself is a complex mechanism that depends on multiple factors such as mineral constituent, concentration, pressure and temperature. Among all the scaling formations, silica and silicate scaling commonly create issues in the binary well, reinjection well, and 2-phase header system. Silica and silicate formation in 2-phase headers is difficult to control due to changing pressure and temperature along the line. The result of these changes affects the phase composition and alters the brine chemistry concentration. A conventional silica-inhibition program might work for metal-free brine chemistry. However, in the presence of metal, a conventional silica-inhibition program can also induce metal-silicate formation.

SITUATION

One of the geothermal power plants in Indonesia expected a silica and silicate deposition issue in their 2-phase brine header which would have likely compromised their plant reliability. If the silica and silicate deposition were left uncontrolled, the risk was an unscheduled plant shutdown to clean the system of scale deposition.

This suspicion was confirmed through a predictive simulation of the risks in the brine using Nalco Water's Geomizer™ modeling tool. After the brine chemistry analysis and advanced modeling, Nalco Water's experts predicted that the 2-phase header system specifically would have a high tendency of silica and Al-silicate scale formation. Existing chemical treatments would not be able to sufficiently control the scale formation, so the geothermal power producer would need to shut down their system for cleaning and forgo days at a time of possible power production.

SOLUTION

Nalco Water's research and development team had been developing an advanced inhibitor program to prevent silica and silicate scaling from forming that could help with

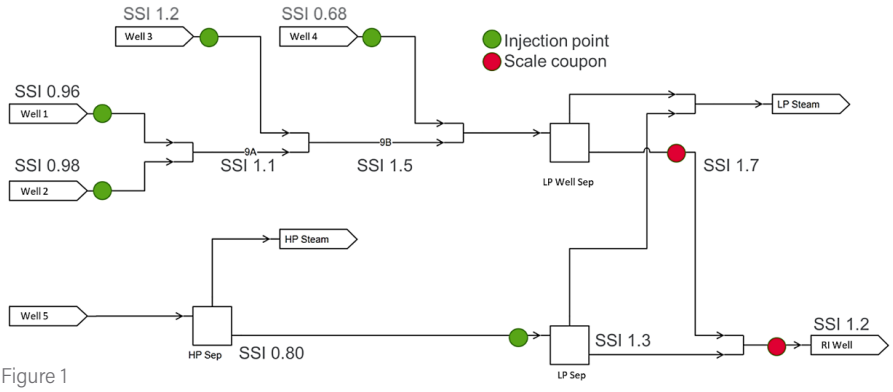


Figure 1

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these challenges. The program's goal was to withstand high temperature and pressure in the geothermal system while also being cost-effective for commercial use. With rigorous effort, the new program has proved to be more effective than traditional inhibition programs.

To mitigate the scale formation and deposition, Nalco Water and the geothermal power producer agreed to implement GEO912 injection, an advanced polymer program that works to inhibit both silica and silicate.

RESULTS

GEO912 implementation shows that silica polymerization is maintained low as displayed in figure 2.

As the silica polymerization maintained low, it indicated that the GEO912 program worked to prevent monomeric silica polymerization and monomeric silica reaction with metal. This leading indicator gave a glimpse of the scaling rate formation. If the silica polymerization is high, the inhibition program implemented is not sufficient to prevent the reaction and deposition.

After 4 months in operation, the scaling rate was also maintained low with 0.03 mm/year at LP well separator and 0.19 mm/year at the reinjection well.

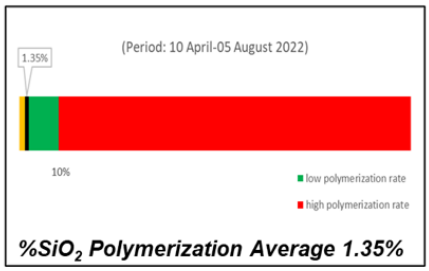
Figure 3: LP Well Separator Scale Coupon (4 months of insertion)

Figure 4: Reinjection Well Scale Coupon (4 months of insertion)

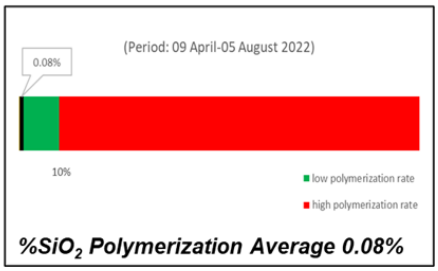
CONCLUSION

Nalco Water's new program for scale control mitigated the scaling risk in a system that otherwise would have required frequent shutdowns for cleaning resulting in a loss of valuable power production time, and stress on plant asset reliability. Based on the results, the Nalco Water's new program provides more reliable operation and less maintenance frequency.

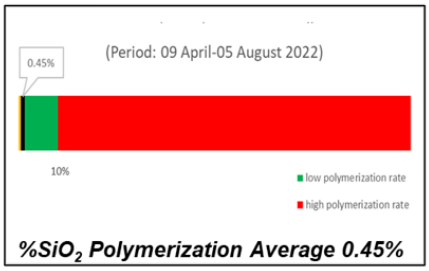
1. Brine Outlet HP Separator



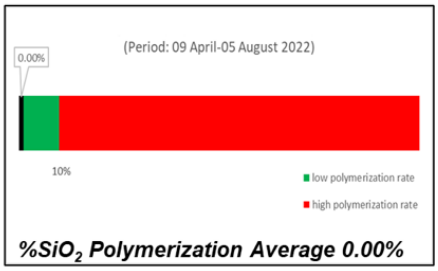
2. Production Well 2



3. Production Well 3



4. Brine LP Well Separator



5. Reinjection Well

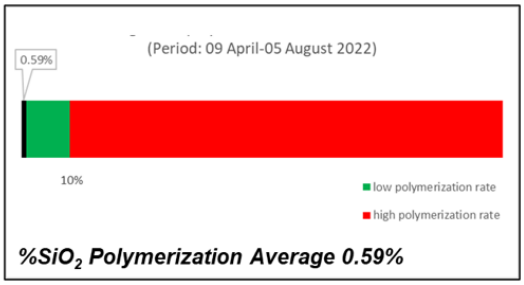


Figure 2

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