

Arsenal Plus™ helps enhance acid gas removal unit by reducing caustic consumption more than 30% at Texas ethylene plant

CASE STUDY

► BACKGROUND

Caustic towers are critical in ethylene plants to remove acid gases from the process stream, namely carbon dioxide and hydrogen sulfide. An ethylene customer in Texas was not experiencing any issues with caustic tower fouling or performance, but had a significant desire to reduce both operational expenses (OPEX) and volume of spent caustic generated. Spent caustic disposal involves a truck transporting the waste offsite for injection to a deepwell. Since new deepwell permits are not available, the customer wanted to minimize spent caustic flows.

Nalco Water, an Ecolab Company, proposed an innovative dual chemical treatment program to meet their desired goals. Leveraging the synergistic effects of both chemicals, Nalco Water approached the customer with anticipated benefits of significantly reducing cost reduction and minimizing waste. The proposal also highlighted potential improvements, such as enhanced fouling control and the ability for the acid gas removal unit to handle higher CO₂ content, aligning with the customer's goals of efficiency and sustainability.

► SOLUTION

The improvement was developed through a strategic injection and adjustment of two Nalco Water Arsenal inhibitor chemicals into the different sections of the customer's Caustic Tower system. Arsenal Inhibitor #1 was fed to the upper section while Arsenal Inhibitor #2 was injected to the lower section. Over several weeks, the concentrations of both chemicals were systematically adjusted to optimize performance. Each adjustment led to a noticeable improvement in the quality of the spent caustic and a reduction in the overall quantity generated. The unique synergistic reactions between the two chemicals to economically and efficiently react with CO₂ and acetaldehyde, reducing caustic consumption and mitigating fouling. This approach ensured that the customer's system operated more effectively and sustainably.

Specific actions were taken to ensure the successful implementation of this solution. Nalco Water collaborated closely with the customer to determine the optimal injection points and concentration levels for the chemicals. Safety, sustainability, and quality were primary considerations throughout the process, ensuring that the solution not only met but exceeded the customer's expectations. Comprehensive training for the operations team was conducted to ensure smooth implementation and ongoing maintenance of the improved system. The entire process was carried out over the course of several months, with continuous monitoring and validation to ensure desired outcomes.

eROISM
by Ecolab

ANNUAL SAVINGS



WASTE

\$12,500 Monthly

45% Reduction in Spent Caustic to Deep Well



ASSET PROTECTION

Improvement

in adol polymer fouling control was seen in gums testing



LOCATION PRODUCTIVITY

\$32,500 Monthly

156K lbs of makeup caustic



TOTAL VALUE DELIVERED

\$540,000
Annually

► RESULTS

The treatment program successfully reduced both spent caustic generated and makeup caustic by 35% to save the customer \$250,000 a year even when factoring in the chemical program costs. Additionally, the customer agreed that future optimizations are possible once an issue with a problematic control valve is addressed.

Additional benefits include a drastic improvement in spent caustic quality, improved caustic tower response to CO₂ upsets, and allowing operations to consider lowering caustic strength in the tower for increased savings. Gums testing confirmed proper aldol polymer mitigation even with increased retention time.

► CONCLUSION

Arsenal Plus improved the efficiency of CO₂ removal and significantly decreased caustic consumption while continuing to mitigate aldol polymer formation. Total OPEX reduction to the spent caustic and makeup caustic costs totaled \$540,000 a year even with limitations to program optimization. The customer views the treatment program as a success and has already committed to replacing the valve in question that is limiting total savings. Since deep well injection is the most economical if not readily available disposal option, Arsenal Plus will help provide higher OPEX savings to ethylene customers with different spent caustic processes.