

# AQUAMAX™ Program Results in Annual Savings of \$4.6 MILLION for Ethylene Plant



## BACKGROUND

A new, world-scale gas cracker was experiencing frequent, repeated fouling in the dilution steam generator (DSG) reboilers. The premature formation and accumulation of fouling across the reboilers was not only a reason for the additional maintenance cost (cleaning), but it also increased medium pressure (MP) steam consumption and wastewater cost, and led to reduced dilution steam production. The plant was accustomed to the cleaning of three to four reboilers every month. The total associated cost of operations due to fouling worked out to more than \$3 million per year. With the application of a systematic improvement strategy, the Nalco Water technical, marketing, and local field teams were able to provide excellent pH control and reduce oil carryover to the DSG, which resulted in reduced fouling of the DSG reboilers. Full implementation of the Nalco Water AQUAMAX program was instrumental in achieving this result.

## SOLUTION

The first step for the Nalco Water team was to understand the reason for the premature and fast-fouling accumulation in the DSG reboilers.

A combination of medium-to-high oil residual in the process water, due to the mechanical design and operation, was responsible for the issue. The Nalco Water team, by systematic troubleshooting and a well-directed course of action, aimed at resolving the issue, reducing the fouling accumulation in a few months. At this stage, the first step was to maximize the oil removal at the QW separator and DOX sections.

A careful review of the QWS performance, oil contribution (mainly from the interstage knockout drums from the charge gas compressor) and DOX operations, quickly led to a better de-oiling of the process water. The second step was to increase the pH control at the QW section to maximize the emulsion-breaker performance, and reduce pH variations responsible for bad oil removal. The third step was to increase the DSG antifouling dosage up to a point where the best fouling particles are dispersed and removed through continuous blowdown (CBD).

The following graphs depict the improved pH control at the QW section and the consequent reduction of oil content in the process water, measured by water turbidity on the separator out.

## ANNUAL SAVINGS

### ASSETS

Reduced fouling in reboilers led to reduced cleaning frequency, bringing it down to once in a month

**\$326,000**

### ENERGY

Reduction in imported MP steam due to the fouling of reboilers

**\$2.6M**

### WATER

Reduction on effluent and oil contribution to WWTP

**\$1.7M**

## VALUE DELIVERED

**\$4.6M**

## RESULTS

### Environmental Benefits

When the Nalco Water team closely monitored the frequency of the fouling of the DSG reboilers, as well as other KPIs related to the plant's health, the following results were observed during one year of continuous improvement.

- Reduction of fouling in reboilers and cleaning frequency from three to four times per month to once a month

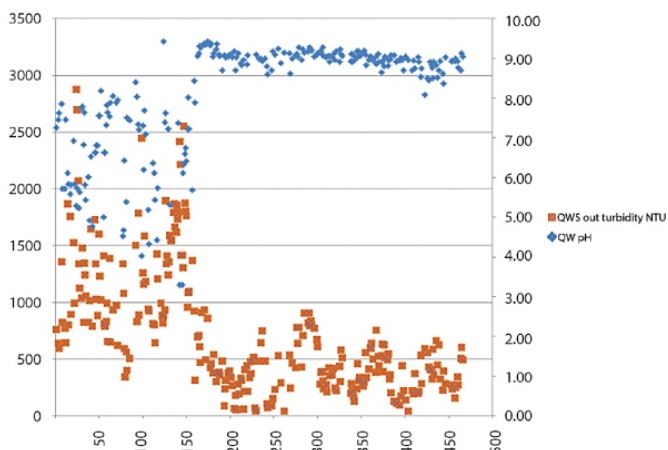


FIGURE 1: GRAPH OF THE QW SECTION FOR ITS PH AND TURBIDITY

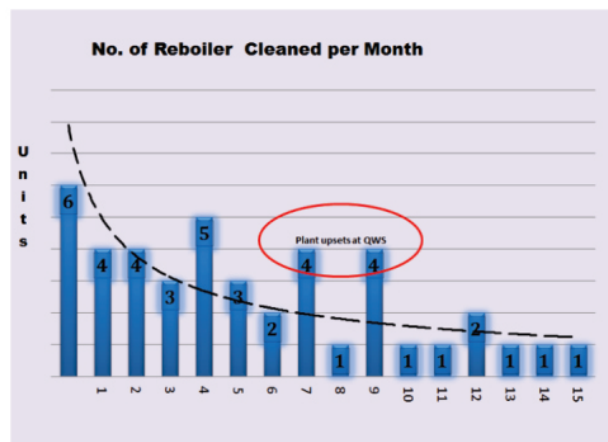


FIGURE 2: GRAPH OF REBOILERS DEPICTING THE TRAJECTORY OF ITS CLEANING FREQUENCY

- Reduction of imported MP steam due to the fouling of reboilers putting them out of service
- Reduction of effluent to wastewater treatment plant (WTP) from the DSG blowdown
- Reduction of oil contribution to WWTP from any dilution steam system water drain

### Economic Returns

The above environmental indicators led to the following savings over a 12-month period.

- Money saved on mechanical/cleaning costs amounted to \$326,000
- The reduction in imported steam cost led to savings worth \$2.6M
- Oil contribution to WWTP decreased resulting in savings worth \$1.7M

The resulting economic savings from the application of the AQUAMAX neutralizer and antifoulant were over 10 times greater than the cost of the chemicals. The chemical costs were recovered within three weeks of the full implementation of the Nalco Water proposals. The total net savings, after chemical consumption costs, were estimated at \$4.6 million per year, not just considering indirect savings related to safety and environmental items.

### CONCLUSION

As a direct outcome of the implementation of the Nalco Water AQUAMAX program at the new gas cracker plant, the fouling in the reboilers was controlled, decreasing their cleaning frequency. The Nalco Water program also solved other problems prevalent at the plant. It reduced the need to import MP steam and also reduced effluent and oil contribution to the plant, thereby resulting in total savings worth \$4.6 million per year.

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