

3D TRASAR™ Technology for Crude Overhead Systems Identifies Root Cause of Low pH Events



INTRODUCTION

Corrosion of atmospheric tower overhead system can be a serious problem in crude distillation units due to formation of hydrochloric acid at dew point. Neutralizers and caustic are used to control the pH at dew point, and filming amines are injected to reduce the rate of corrosion. Fluctuations in the amount of acids present in the overhead system cause the neutralizer and filming amine demand. The 3D TRASAR Technology for Crude Overhead Systems (COS) enables real time measurements of key parameters that promote corrosion in the overhead system, and is a unique tool for identifying mechanical, operational and chemical root causes of corrosion.

PROBLEM

A large Gulf Coast refiner experienced a series of corrosion failures on the atmospheric overhead line, which resulted in significant refinery downtime and repair costs. Prior to the overhead leaks, manual sample data revealed periods of significantly low pHs ($\text{pH} < 3$) in the condensed water for durations as long as 12 hours. The root cause of which wasn't immediately apparent, due to the lack of sample data and the infrequency of events.

SOLUTION

Following an incident investigation, Nalco Water's 3D TRASAR technology was implemented and connected to the distributed control system to help the site understand real time behavior of the chloride concentration, pH and iron levels in the overhead system. The 3D TRASAR system was set to send an alert to Nalco Water and customer operations personnel whenever conditions of high corrosion risk occurred.

RESULTS

Chloride spikes and pH drops became noticeable when water in the hot accumulator fell, indicating reduced tolerance for process variability. Each evening, the 3D TRASAR system consistently sent an alarm that pH had dropped 0.3 pH units and chloride spiked from 50 PPM to 100+ PPM. Nalco Water and the customer found what appeared to be a short duration upset condition occurring on a train of desalters approximately 30-40 minutes before each pH/Chloride event (Figure 2).

Further investigation showed these events aligned with desalter mud washes where, in addition to short-term pressure fluctuations, caustic flow dropped to 0.0 GPM between 30 to 40 minutes - the same duration as the atmospheric

VALUE DELIVERED

ASSETS

Reliability Cost Savings

\$6.7MM ANNUALLY

overhead events identified by the 3D TRASAR Technology for COS (denoted by the blue circles in Figure 2). Caustic flow rate reduction was the result of pump mechanical issues, which stopped caustic flow during short-term pressure fluctuations. A mechanical survey performed on the desalter identified mud wash piping and operational differences between desalter trains as the root cause for the pressure fluctuations.



FIGURE 1: 3D TRASAR FOR CRUDE OVERHEAD SYSTEMS EQUIPMENT

These differences could not be addressed while the unit ran, so the caustic pump was repaired to ensure caustic injection during mud wash, thereby eliminating the pH/chloride nightly events.

In addition to the mud wash loss of caustic, Nalco Water and the customer quickly recognized blockage in caustic and neutralizer pumps, as well as a failed external caustic relief valve before causing a corrosion event. Furthermore, new crudes were consistently evaluated using 3D TRASAR technology.

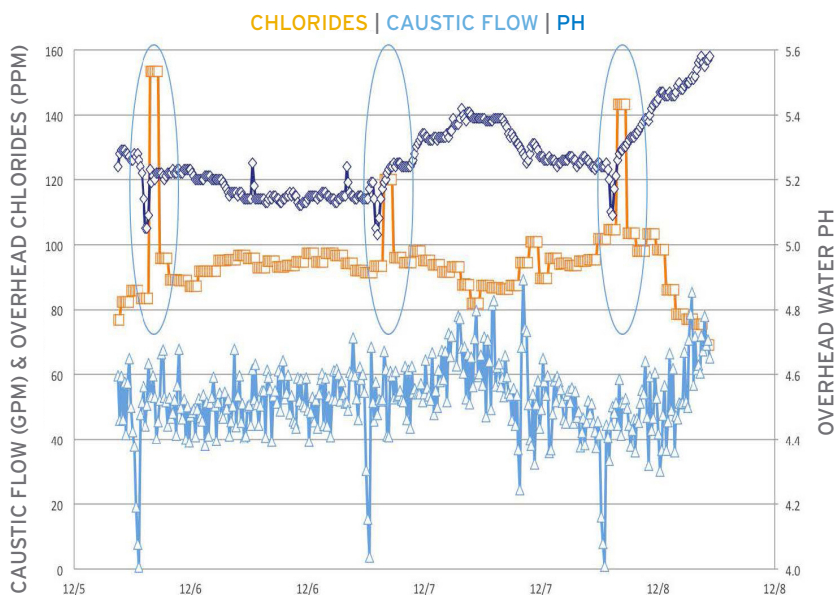


FIGURE 2: 3D TRASAR TECHNOLOGY FOR CRUDE OVERHEAD SYSTEMS

CONCLUSION

As a consequence of these findings, the mud wash piping arrangement was changed in the next turnaround to eliminate the pressure interference and the overhead condenser bundles were pulled and cleaned in an effort to improve first stage water condensation. Additional mechanical and operational changes were made to minimize corrosion events using the proven 3D TRASAR system.

Nalco Water technology validated the importance of condensing water in the overheads, identified a gap in the mud wash process and highlighted the importance of a reliable caustic delivery system, particularly when overhead water make is low. 3D TRASAR technology also demonstrated its value as a tool to understand mechanical, operational and chemical causes of overhead corrosion; providing the customer with an estimated reliability saving of more than \$6.7MM per year through improved monitoring and alarming capabilities.

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