

Case Study: CH-1697

3D TRASAR™ TECHNOLOGY FOR CRUDE OVERHEAD SYSTEMS IDENTIFIES ROOT CAUSE OF LOW PH EVENTS



Case Study: Refining Process Treatment

INTRODUCTION

Corrosion of the 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 vary the neutralizer and filming amine demand. The 3D TRASAR technology for Crude Overhead Systems (3D TRASAR technology for 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, grab sample data suggested periods of significantly low pHs ($\text{pH} < 3$) in the condensed water for durations as long as 12 hours. The root cause of the low pH events was not readily apparent due to lack of sample data and the intermittent nature of the events.

SOLUTION

Consequently, as an incident investigation action item, the 3D TRASAR unit for COS was put in service and connected to the distributed control system to help the site understand the real time behavior of the chloride

Environmental Indicators	eROI	Economic Results
Minimize refinery downtime and hydrocarbon vapor releases	 ASSETS	Customer approved \$6.7 million reliability cost savings per year
All data verified by the customer		

Nalco Champion reports Environmental Return on Investment (eROI) values to customers to account for contributions in delivering both environmental performance and financial payback.

concentration, pH, and iron level in the overhead system. The 3D TRASAR unit for COS was set up to alarm both Nalco Champion and customer operations personnel to process conditions with high corrosion risk.

RESULTS

Chloride spikes and pH drops became noticeable when water make in the hot accumulator fell, indicating reduced tolerance for process variability. In the evening, the 3D TRASAR unit for COS routinely alarmed that the pH dropped 0.3 pH units and chloride spiked from 50 PPM to 100+ PPM. Nalco Champion and the customer found what appeared to be a short duration upset condition occurring on one train of desalters approximately 30 - 40 minutes before each pH/Chloride event (Figure 1).

Further investigation showed that these events aligned with desalter mud washes where, in addition to short term pressure fluctuations, the caustic flow dropped to 0.0 GPM for 30 to 40 minutes - the same duration as the atmospheric overhead events identified by the 3D TRASAR technology for COS (denoted by the blue circles in Figure 1). The caustic flow rate reduction was a result of pump mechanical issues which stopped the caustic flow during the 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. Piping and operational differences could not be changed while continuing to run the unit, but 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 Champion and the customer were able to quickly recognize blockage in caustic and neutralizer pumps, as well as a failed external caustic relief valve before causing a corrosion event. Furthermore, new crudes are routinely evaluated using the 3D TRASAR technology for COS.

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 monitored by the 3D TRASAR technology for COS.

The 3D TRASAR technology for COS helped to validate the importance of condensing water in the overheads, identify a gap in the mud wash process, and validate the importance of a reliable caustic delivery system - particularly when overhead water make is low. The 3D TRASAR technology for COS demonstrated its importance as a tool in understanding the mechanical, operational, and chemical causes of overhead corrosion. The customer has estimated reliability savings of greater than \$6.7 million per year due to the improved monitoring and alarming capabilities of the 3D TRASAR technology for Crude Overhead Systems.

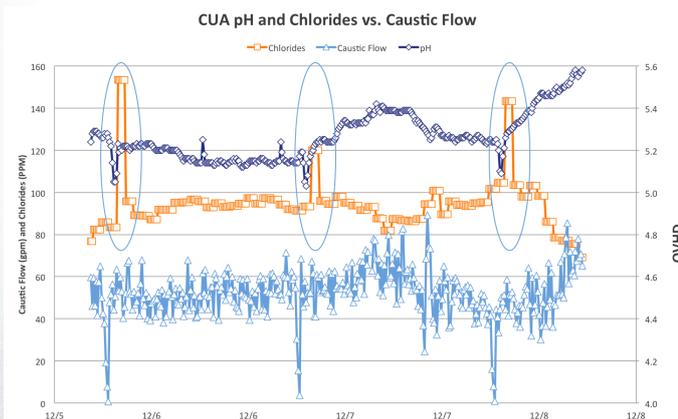


Figure 1

NALCO CHAMPION Locations

Headquarters

7705 Hwy 90
Sugar Land, TX 77478 USA

Asia Pacific:

2 International Business Park
#02-20 The Strategy Tower 2
Singapore 609930

Europe:

Ir.G.Tjalmaweg 1
2342 BV Oegstgeest
The Netherlands

Latin America:

Av. das Nações Unidas 17.891
6º Andar 04795-100
São Paulo SP Brazil

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