Case Study: CH-1330

REFINERY SOLVES LONG TERM CORROSION PROBLEM BY DEPLOYING 3D TRASAR™ TECHNOLOGY FOR CRUDE OVERHEAD SYSTEMS

Case Study: Refining Process Treatment

INTRODUCTION

A gulf coast refinery had a history of corrosion failures in the crude unit overhead exchangers for the past 10 years costing the refiner in excess of $1.0 MM/year in equipment, labor, and lost production. The refinery in question was plugging tubes, retubing exchangers, or replacing exchangers as frequently as every eighteen months. Refer to Table 1 for a corrosion history. The biggest problem the customer faced in trying to resolve this persistent corrosion problem was to clearly identify the contributing factors and directly linking these to unit performance and the exchanger failure rate.

Table 1

Inspection History			
Year	**Exchanger #1**	**Year**	**Exchanger #2**
Year 1	Bundle replaced		
Year 2	Retube C-E-1D installed	Year 2	Bundle replaced
Year 3	Retube	Year 3	Inspection
Year 4	10 leaking tube	Year 5	514 tubes plugged
Year 5	14 leaking tubes	Year 6	Bundle replaced
Year 7	120 tubes plugged	Year 7	Passed inspection
Year 8	235 tubes plugged		
Year 9	Retube	Year 9	1 tube plugged
Year9	1 tube plugged	Year 9	310 tubes plugged
Year 11	Bundle replaced	Year 10	Bundle replaced
Year 12	Inspection no repairs		
Year 12	Inspection no repairs	Year 12	Spare bundle installed
Year 13	Spare bundle installed	Year 13	I tube 60% wall loss

PROBLEM

The customer goals were to eliminate or drastically reduce the corrosion allowing them to run turnaround to turnaround without suffering any downtime or lost production due to corrosion failures. In addition to the direct costs, poor overhead performance was increasing the refiners safety and environmental exposure. Despite valiant efforts, poor corrosion performance could not be significantly reduced with the application of a traditional chemical treatment program. It was suspected that much of the corrosion damage occurring was episodic in nature, and the direct result of operational changes. The customer needed a simple way to measure and track the corrosive conditions resulting from changes in operations linking these directly back to corrosion performance.

Figure 1: 3DTCOS Equipment

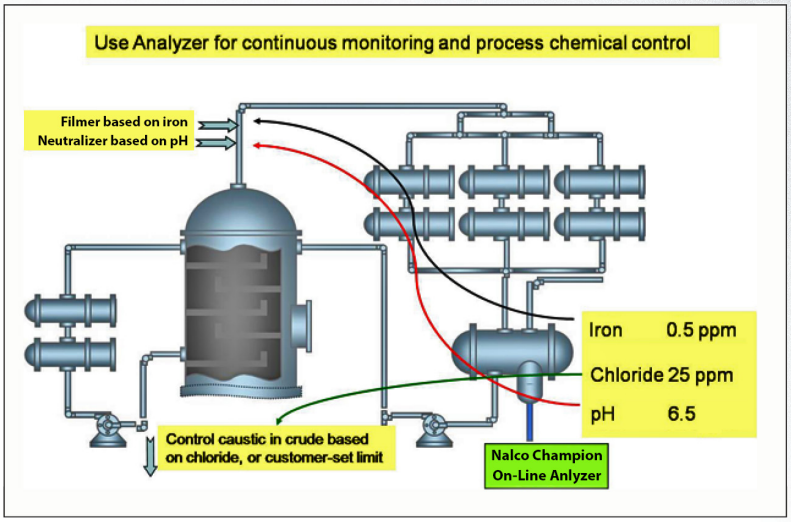

Figure 2: Crude Unit Overhead Schematic

SOLUTION

To meet the customers needs, Nalco Champion deployed the new 3D TRASAR Technology for Crude Overhead Systems. The 3D TRASAR for Crude Overhead Systems analyzer takes a stream of crude unit overhead sour water and in real time determines the corrosive state of this water. Based on this analysis, 3D TRASAR for Crude Overhead Systems analyzer directly controls the addition of caustic, neutralizing amine, and filming inhibitor to the crude unit overhead. The goal is to link the chemical addition directly to the demands of the overhead system. Because this was new technology and yet unproven, 3D TRASAR for Crude Overhead Systems was initially deployed for 18 months in monitoring mode only. No attempt was made to control the addition of chemical additive. During monitoring mode, the goal was to purely observe the system and establish direct linkage between changes in operations and corrosion performance.

It was evident from the very beginning that changes in operations, particularly, desalter upsets, addition of new crudes, and the loss of caustic injection during fresh caustic blending, had a large impact on the corrosion performance. In Year 1, the corrosion rate, as measured by electrical resistance probes, had averaged 10 mil/yr (Figure 3). In actuality the real corrosion rate, as measured based on the failure rate, was closer to 40 mil/yr. On many occasions decreasing pH and increasing chloride and iron concentrations were observed during the 18 months in monitoring mode (Figure 4). As can be clearly seen from Figure 4, considerable damage occurred during these periods of upset conditions.

Once a firm link had been established between upset conditions and changes to unit operations, 3D TRASAR for Crude Overhead Systems was placed into control mode. During control mode the addition of caustic, neutralizing amine, and filming inhibitor were injected based on the demands of the system and not a predetermined baseline dosage. As can be seen from the attached graph (Figure 3), controlling chemical additives based on system demands had a big impact on reducing the refiner's overhead corrosion rate. A further improvement was achieved with the unit in control mode. Previously, corrosion had peaked in Year 1 at 10.57 mils/yr, and prior to the implementation of 3DTCOS, Year 4 at 8.46 mils/yr. With the advent of manual control, corrosion was reduced by 50% during monitoring mode, and further reduced 44% during

control mode. As an added benefit to the reduced corrosion, and the savings of approximately $1.0MM/yr, the refiner actually consumed substantially less chemical additive to the tune of $169,000/yr from Year 4 onwards.

CONCLUSION

It is clear from the data presented that automating the addition of caustic, neutralizing amine, and filming inhibitor to the crude unit has dramatically improved corrosion performance while at the same time reduced chemical consumption, saving the customer $1.16MM/year in total operating costs. The calculated Return on Investment for this application is $5.0MM for an investment of $1.0MM over five years.

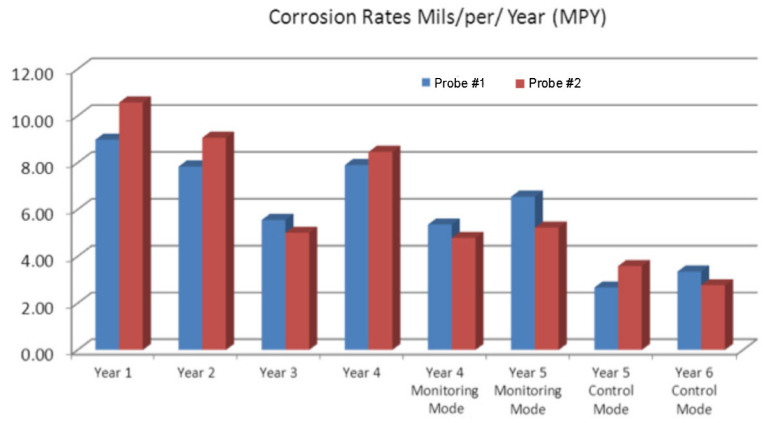

Figure 3

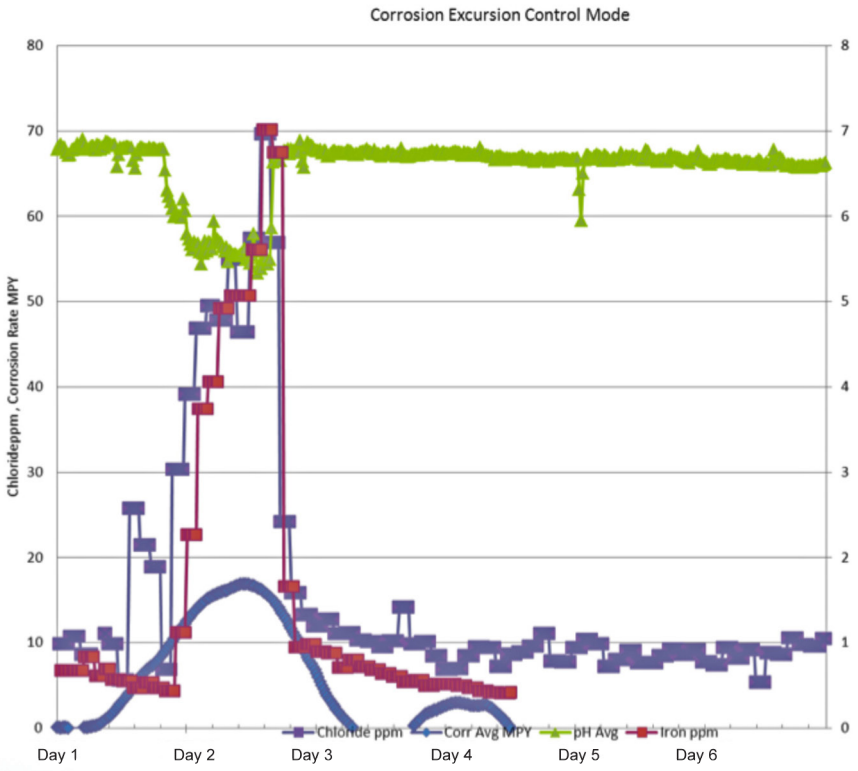

Figure 4

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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