Case History

Heat Exchanger Failure Analysis

A Gulf Coast refinery experienced failures of two admiralty depropanizer heat exchangers after 28 years of service and failures of replacement carbon steel heat exchangers after only ten months of service. The admiralty corrosion rate has consistently exceeded the maximum specification rate of 0.2 mpy during the last two years of service.

Examination of the failed section of the admiralty bundles showed extensive under-deposit corrosion. (Figure 1)

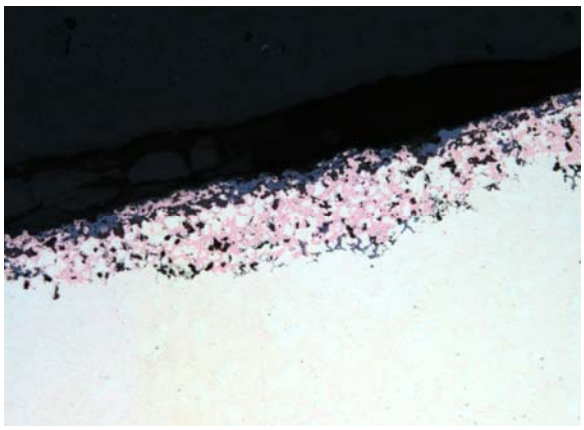

Figure 1 – Cross Section of Tube Wall of Admiralty Heat Exchanger

Our investigation identified high concentrations of suspended solids as the source of deposits on the heat transfer surfaces. Concentration of acidic species, especially chlorides, caused corrosion under the deposits. Poor chlorination practices deactivated the copper corrosion inhibitor and exacerbated the copper corrosion rate.

The corrosion rate in the carbon steel heat exchangers was very high, creating tubercles on the tubesheet (Figure 2) and the heat transfer surfaces.

Figure 2 – Tubesheet of Carbon Steel Heat Exchanger

A review of the ten-month operating history and conformance to specification limits for water quality indicated that a process leak occurred immediately after installation of the carbon steel heat exchangers, before in-situ passivation occurred.

To reduce the risk of additional failures, MarTech recommended that refinery personnel optimize the clarification process for the make-up water to reduce the concentration of suspended solids, change the feed protocol for chlorine and azole to minimize deactivation of the copper corrosion inhibitor and initiate an off-line passivation procedure for new carbon steel heat exchangers.

35 Viburnum Court, Lawrenceville, NJ 08648-4809 • Office: (609) 896-4457 • Fax: (760) 280-9823
E-mail: info@martechsystems.com • Web Site: www.martechsystems.com