CRUDE AND HYDROCRACKER UNIT
PROCESS CORROSION REVIEW

OVERVIEW

Following several pressure equipment integrity related incidents that resulted in the release of hydrocarbon vapour, Quest Integrity experts were engaged to undertake a comprehensive review of process corrosion threats and mitigations to optimise unit operation and integrity. The incidents occurred due to a leak in crude heater transfer line, and then from a drain in the hydrocracker reactor effluent line.

BACKGROUND

Hydrocracker units are commonly used to upgrade the naptha cut from the crude tower to higher value products in a refinery. Hydrocrackers operate at high temperatures and pressures and the consequences of a hydrocarbon release can be extreme. In this case, the processing regime for the refinery had changed during the years since the hydrocracker complex had been commissioned. The complex had been designed to process relatively “sweet” crudes but pressure on margins over the proceeding 15 years had resulted in incremental changes to the crude blends being processed. The refinery was now processing a more varied crude slate which included “opportunity” crudes with relatively high acid content (TAN) and in some cases, a high total sulphur content (>2.5wt%). In addition, a number of the crudes being processed were relatively heavy resulting in less efficient desalting.

The consequence of the progressive change in crude processing environment was increased rates of sulphidic corrosion in the crude heater transfer line alloy steel pipework together with localised naphthenic acid corrosion in the carbon steel light gas oil draw pipework and lower reflux pipework. Furthermore, overhead corrosion in the crude distillation unit and increased fouling of the reactor effluent air coolers due to ammonium chloride deposition was also being observed.

SOLUTION AND RESULTS

The refinery had no systematic process or procedure for assessing the potential impact a particular crude blend would have on corrosion rates. They were therefore unable to accurately evaluate the impact a particular processing decision would have on unit integrity.

Quest specialists reviewed the operation of the complex, along with its design and materials of construction, and developed detailed corrosion control documents. The documents defined the specific corrosion risks for all areas of the units as well as critical parameters that must be monitored during operation. These parameters were then used to define “Integrity Operating Windows” (IOWs) for the unit. If operation was maintained within these windows, corrosion rates would be maintained at acceptable levels. If the windows were exceeded, specific guidance on corrective actions was available.
The immediate benefit of implementing IOWs was increased inspection focus and effectiveness, as well as marked improvement in unit integrity and reliability, and evidential confidence in the integrity of the pressure equipment. Furthermore, effective crude processing decisions could be made on the basis of the IOWs established. A subsequent benefit of this process corrosion review was the development of holistic refinery wide processes for integrity management that involved all disciplines, including refinery leadership, that led to a journey of continuous improvement for the site.