Case study

HDS preheat fouling control

Problem

A fully integrated refinery was block operating a distillate hydrodesulfurization (HDS) unit using gas oil, diesel, and naphtha as feedstocks. Most of the feed components were straight run materials with very low fouling potentials. A small percentage of the feed was Visbreaker naphtha and diesel products.

Once the sulfur was removed in the HDS process, the hydrocarbon product was fractionated into a series of low sulfur products and blend stocks. Using this feed blend, the HDS run lengths were more than one year. Catalyst activity was the run limiting factor.

In late 1995 the refinery commissioned a new delayed coker. Light and heavy gas oil and naphtha from this unit were immediately added as hot rundown streams to the HDS feed system. Almost immediately the feed preheat exchangers began to experience severe fouling and the pressure drop across the guard reactor began to steadily rise. The first run following the coker start-up lasted only four months due to a combination of the preheat fouling and guard reactor pressure drop. Typical operating conditions are 760 psig (52 kg) pressure and 750°F (400°C).

Solution

During the initial run, the Baker Hughes R&D group conducted a series of feed quality analyses and ALCOR evaluations to select an appropriate antifoulant product. Due to the combination of straight run and coker feedstock components, a three product approach was deemed the most effective. Once the guard reactor had been skimmed and the preheat exchangers washed out, BPR 31590 and TOLAD™ 9022 antipolymerants were begun to the combined rundown of the coker gas oil and naphtha. BPR 31725 dispersant was initiated at the suction of the HDS feed charge pump.

Results and benefits

The following figure shows the trends of the U coefficient and the fouling factor for the preheat train "hot" exchanger as calculated by Baker Hughes computer modeling program. This exchanger was seen to be the most severely fouled and identified as the most critical monitoring point. Exchanger fouling has been reduced to a minimum, and guard reactor life has been more than doubled. Costs have been contained within budget with fouling factors aligned with target cleaning dates.