

# Online Heat Exchanger Cleaning

## Project

ZymeFlow was engaged by a large scale refinery in the US to evaluate improving heat exchanger efficiency of a series of pre-heat exchanger on a diesel hydrotreater unit. They were processing opportunity crudes and changing the feed quickly. The exchanger was open at 100% flow with diminishing capacity. In addition, with the reducing efficiency during operation, site had to endure with ever lower processing capacity flow to the reactors. The refinery had attempted to inject other industry chemicals in-situ without success. The ZymeFlow proposed injection was approved to try and avoid a shut-down for external manual HEX cleaning which would be a significant cost to the plant and the regions strategic diesel contracts. The refinery was running at full capacity and just finished a major turnaround the year before therefore could not afford to shut the unit down for cleaning.

## Challenges

Due to the unit configuration, the site was unable to isolate individual exchangers and perform any form of serial heat exchanger cleaning while the unit was in operation so the only option was to do an online cleaning. Commodity chemicals had already been tried, without any success.

## Engineered Solution

Based on the unit process conditions, the ZymeFlow Engineering team evaluated and recommended Rezyd-HP®, as an online additive to the process stream. Rezyd-HP is a high solvency, proprietary blended chemistry, formulated to fluidize hydrocarbon deposits. The chemistry was also ideal as it is stable over a wide range of temperatures.

Parameter	Before Treatment	After Treatment	Improvement
Unit Feed Rate (BPD)	23,100	22,997	-
Feed Valve Position (% Opened)	100%	71%	29%
Feed Preheat Temperature (C)	94	125	31 C
Exchanger U-Value (BTU/hr ft <sup>2</sup> °F)	17	29	13 BTU/hr ft <sup>2</sup> °F
Exchanger Tubeside dP (psi)	90	70	20 psi

Given the unique application on live process, detailed discussion and multiple levels of approval had to be obtained from several departments in the organization including: Environmental, Engineering, Product Quality and finally the US Regional Hydroprocessing Director. Many tests were performed to make sure the chemistry would be safe downstream. After months of analyzing, it was determined that based on the engineered injection rates, there would be no negative impact on catalyst.

The chemistry was injected upstream of the pre-heat exchangers over a period of 1 hour every 4-8 weeks at varying doses depending on the estimates of plugging. Key parameters were monitored such as exchanger dP, U-Value, feed temperature, and reactor temperature.

## Results

Post online injection of the chemistry, the site saw significant enhancement in HEX efficiency including an over 70% improvement in U value, and 33% improvement in temperature. The site avoided a shutdown and was able to maintain production capacity during the injection of the chemistry. There was also no impact to reactor performance and no loss in product quality. ZymeFlow's approach improved the financial operation of the unit by eliminating unit shutdown and increasing the average production capacity during operation.

The site continues to inject Rezyd-HP chemistry every 4-8 weeks depending on monitored parameters. They have been able to avoid an unplanned shutdown for more than 3 years using ZymeFlow online cleaning. They expect the unit to stay online until their regularly scheduled turnaround which will be cleaned by ZymeFlow.