

Kern Oil & Refining Co.

Incident Investigation of the October 18, 2017 NHT Charge Heater Fire

1 BACKGROUND

1.1 Introduction and Overview

On October 18, 2017, just before 8:00 p.m., a heater tube in Kern Oil & Refining Co.'s ("Refinery's") Naphtha Hydrotreater ("NHT") Charge Heater failed ("Incident"), internally releasing naphtha-range feed into the heater, which resulted in an ignition and fire. The fire was extinguished in less than 10 minutes. No reportable substances were released to atmosphere, and there were no off-site impacts or injuries as a result of the Incident.

Response Actions: The Refinery's operators and the Shift Supervisor immediately took response actions, including directing security personnel to call the Kern County Fire Department ("KCFD"). Personnel assumed their emergency response duties to secure the unit, removed fuel gas from the heater, eliminated charge to the unit, and shut down/blocked in pumps and compressors. Operators also immediately activated fire monitors and directed them towards the heater. Additional personnel took action to control the fire by applying snuffing steam to the heater firebox and confirming operation of the emergency firewater engine for boosting pressure to the system.

Agency Notification and Response: KCFD arrived at 8:09 p.m., and remained onsite for precautionary monitoring. Additional agencies responding to the Incident included Kern County Environmental Health Department and San Joaquin Valley Air Pollution Control District.

1.2 Investigation Team Composition

The Refinery convened an Incident investigation team on October 19, 2017, at approximately 8:00 a.m. Team members included representatives from the Refinery's Safety, Engineering, Operations, and Maintenance departments.

1.3 Root Cause Analysis Methodology and Materials Reviewed

The investigation team applied a Root Cause Analysis methodology in its investigation. The team reviewed the NHT Unit 2018 Damage Mechanism Review ("DMR") Report, 2018 NHT Hierarchy of Hazard Controls Analysis

(“HCA”) Report, and the November 2015 NHT Process Hazards Analysis (“PHA”).

2 ROOT CAUSE ANALYSIS, CONCLUSIONS, AND RECOMMENDATIONS

2.1 Analysis and Findings

A post-Incident metallurgical evaluation of the failed NHT heater tube indicated there was an approximate service life reduction of 50% in NHT radiant heater tube wall thickness due to oxidation and pitting of the outside diameter (“OD”) surface. The results confirmed external corrosion as the most likely damage mechanism based on to the sulfur content of the fuel gas, although burner fuel quality had improved following the installation of the refinery’s Liquefied Petroleum Gas (“LPG”) Recovery Unit. Additionally, UT data pertaining to NHT Feed Heater showed variations in loss of wall thickness between thickness measurement locations (“TMLs”) in the same pass of the NHT heater. While new NHT charge heater radiant section tubes had been ordered at the time of the incident, installation was pending at the time of the failure in October 2017.

2.2 Conclusion and Root Causes

The tube failure was caused by a reduction in nominal wall thickness due to oxidation and pitting of the tube OD. There were no injuries, illnesses, or fatalities associated with the Incident. The investigation team identified the Refinery’s preventive maintenance program and risk acceptance criteria as improvement opportunities and root causes of the Incident.

2.3 Interim Measures and Recommendations

Interim Measures: New radiant section tubes and a new convection section box with new tubes were installed in October 2017. The tubes were heat-treated and all new welds were X-rayed post-heat treatment to confirm their fitness for service. All tubing and instrumentation were replaced in-kind. All peripheral heater equipment and controls were inspected and repaired/replaced as needed.

Recommendations:

- Enhance mechanical integrity database to improve monitoring and tracking of corrosion rates [Implemented on March 30, 2018].
- Develop an inspection plan that addresses the scope of inspection, inspection intervals, and inspection types for Naphtha Hydrotreater Charge Heater [Completed on September 30, 2018].

- Enhance UT program pertaining to the NHT Feed Heater to confirm short and long-term corrosion rates for locations where more severe corrosion may occur; perform targeted infrared inspections on the NHT Charge Heater. [Completed on June 19, 2018]
- Consider installing tubeskin thermocouples to detect localized temperature excursions and allow corrective actions to be taken in a timely manner. [Completed on June 19, 2018]
- Update Overall Fixed Equipment Mechanical Integrity Program practices and documentation to include learnings from NHT Incident investigation. [Completed on January 11, 2019]