CASE STUDY

OISD/CS/2024-25/P&E/16 Dt.: 31/01/2025

INTRODUCTION

Title: Naphtha Splitter Reboiler Furnace Fire Incident.
Location: Refinery
Loss/ Outcome: Property Damage

BRIEF OF INCIDENT

Fire incident occurred in the furnace of Naphtha Splitter (Part of Isomerization Unit). The Refinery's operating team and fire personnel responded immediately, and the fire was extinguished in about 22 minutes. There were no injuries/casualties due to the incident.

Site Photographs

Provided for information purpose only. This information should be evaluated to determine if it is applicable in your operations, to avoid recurrence of such incidents.

OBSERVATIONS / SHORTCOMINGS

1. As per Licenser feed specification, Naphtha Splitter column was designed for three wide range naphtha streams, however one stream from AU-1 was also routed to column. Management of change was not evident for the change in feed streams, neither was there any vetting from the licensor.
2. The furnace was offered for inspection in year 2015. Inspection report inference regarding no thickness loss and satisfactory tubes external surface seemed to be contradictory to its own statement of thick scaling on external surface. Further, values of tube thickness obtained was not mentioned in the report neither was the thickness survey technique adopted or the tool utilised.
3. ISOM unit shutdown was taken in year 2021 for maintenance job. When manhole of the furnace was opened for inspection, smell of naphtha was detected. After extensive thickness gauging of the complete radiation tubes, convective return bends and convection shock tubes, 55 number of furnace tubes and fittings were replaced during the shutdown.
4. The studded convection tubes above the shock tubes were not inspected because of approach problem.
5. Inspite of heavy corrosion in Naphtha Splitter reboiler furnace tubes after 2021, enhanced monitoring/ testing, particularly with respect to Sulphur & Moisture, of Naphtha Splitter feed quality was not evident.
6. Naphtha Splitter reboiler furnace tripped at low column bottom level due to very high feed moisture in Jan'23, but no root cause analysis was evident for the process upset.
7. MOC was raised for installation of coalescer along with pre-filter upstream of Naphtha Splitter feed surge drum to handle feed moisture problem. However, no further action on the MOC was evident.
8. The residual life calculation subsequent from 2021 was not in-line with OISD-STD-133.
9. On the day of incident at 17:16 hrs, furnace tripped on fire box pressure high and at the same time black smoke observed in CCTV footage.
10. Fire was extinguished at 17:39 hrs, after extinguishing the fire, cooling operation was continued till 17:53 hrs.
11. Later Naphtha leakage was noticed from convection section tube. The concerned tube thickness was not checked in year 2021 shutdown.

REASONS OF FAILURE / ROOT CAUSE

Fire in the furnace was result of naphtha leakage from the Naphtha Splitter reboiler convection bank tube. Failure of tube in convection section led to leakage of naphtha and resultant fire in reboiler furnace. The naphtha (class-A hydrocarbon) caught fire due to the high temperature (around 720^{o}C in arch) in the furnace. Tube failure can be attributed to high rate of corrosion.

RECOMMENDATIONS

1. MOC system in line with OISD-STD-178 to be followed for all changes. Further, any scheme raised in MOC system should be drawn to its proper conclusion. The same shall be pursued or dropped (with proper reasoning) in a time-bound manner.
2. Inspection report shall include all the observations in details like thickness reading, observation, thickness measurement techniques/ tool used, measuring equipment details with calibration date, recommendations, exclusions (areas not covered), etc. Studded tubes shall also be inspected in line with OISD-STD-133.
3. The monitoring of critical parameters, feed quality, etc. should be strengthened/ frequency increased for known failure cases.
4. API standard 530 shall be used to calculate remaining life of heater tubes as stipulated in clause no 10.2.4 of OISD-STD-133. Corrosion rate shall be determined separately for each pass and accordingly remaining life shall be calculated.
5. Process trip incidences should be properly investigated and record to be maintained in line with clause no 7.4.13.1 of Working Group Recommendations.
6. Shut Down planning of units shall be decided based on the health of the critical equipment and activities shall be taken up accordingly.