CASE STUDY

OISD/CS/2024-25/P&E/09 Dated: 23/09/24

INTRODUCTION

Title: Fire incident during maintenance activity.
Location: Refinery
Loss/ Outcome: INR 85 lacs

BRIEF OF INCIDENT

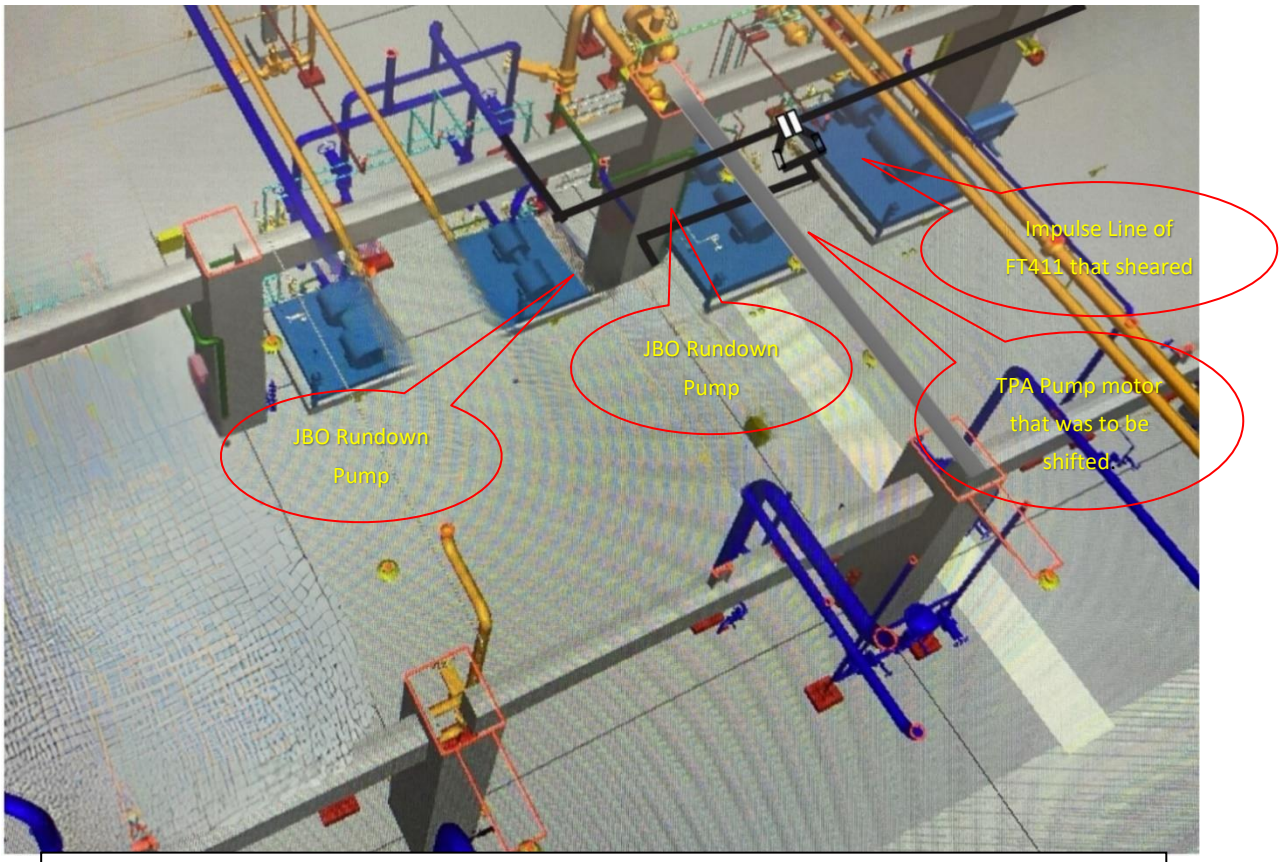
The motor of total pump around (TPA) pump of Jute Batching Oil (JBO) stripper column in vicinity of the stripper rundown pump and located below the pipe rack in Combined Distillation unit(CDU), was to be removed from field and taken to workshop for shaft hub job to align it with the new coupling. The forklift was brought to the location for motor removal job. Two contract workmen of rotary department hooked up a web sling in eye bolt of the motor to lift it, but fork could not be brought above eyebolt level as its travel was restricted due to an overhead beam of the pipe rack. Hence, the lifting was stopped, and the forklift backed out. While backing the forklift, a sudden release of hot hydrocarbon occurred. The released hot hydrocarbon caught fire within moments.

OBSERVATIONS / SHORTCOMINGS

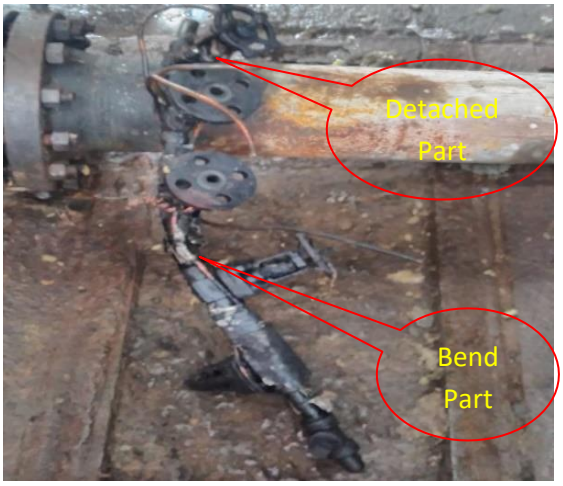
At the time of site visit by the investigation team, the following were observed:

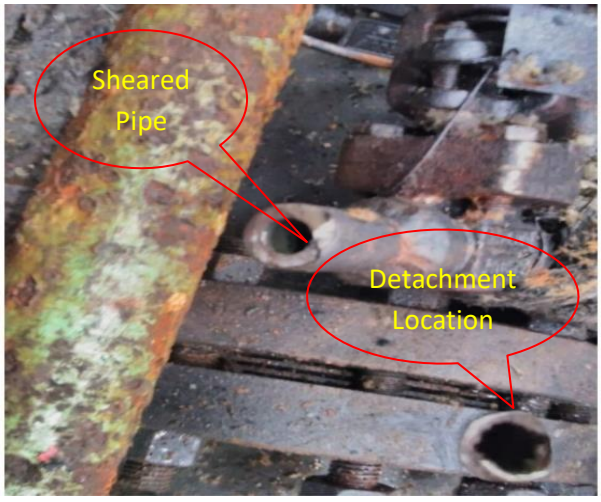
1. One of the impulse line HP tapping of flow transmitter of JBO rundown pumps' common discharge line, was found sheared from the orifice flange (upstream of root valve).
2. The flow transmitter connection piping upto root valve was found bent implying being hit and dragged.
3. The impulse line was just above the TPA pump whose motor was attempted to be lifted.
4. The height of the tapping was 3350mm. The forklift mast height was 2250mm. On lifting the forklift, the height can reach upto 3500mm.
5. There was a scaffolding immediately in front of motor of TPA pump that was hindering free movement of both man and vehicle. This was built in two month ago for completing the post turn around insulation jobs in pipe alley.
6. Process parameter was checked for any abnormality but was found normal in DCS trends prior to incident.
7. The JBO rundown was at the temperature of 331°C. The autoignition temperature of the material was 310°C.
8. Although the site survey had been done by the Maintenance Engineer prior to execution of job, he had failed to assess the clearance available for lifting of the motor, resulting in failure in task of upliftment of motor.
9. It was observed that in the work permit issued for vehicle entry under the hot work permit category, any requirement of JSA and supervision was not mentioned.

10. The unit was under M&I shutdown four months ago of the incident. During the M&I shut down, hydrotest of the JBO circuit was done at 20kg/cm2 and no leak/ pressure drop had been observed. Thickness survey was also carried out of the same circuit and thickness was found in allowable limit.



3D Schematic of incident area





Pictures of damaged equipment taken after the incident

11. It was observed that unit shutdown was initiated after 5 minutes of fire. subsequently JBO pump was stopped after 12 minutes of fire and rundown control valve was closed after 14 minutes of fire. The pressure in the line was 10 kg/cm2g at the time of incident. Accordingly, the material in the line must have continued to gush out with high flow till the pump was

stopped. Subsequently, the flow must have ebbed till the line emptied, resulting in significant release of hot hydrocarbon in open atmosphere

12. JBO Pump one year PM records checked for any abnormal vibration or another abnormality, but no abnormality was observed.
13. Forklift fitness certificate was (FORM-11) in order and the equipment was fit for use. Forklift operator's driving license was valid for forklift operation.
14. In the forklift work-order/ contract did not mention about any training requirement of forklift operation. Induction safety training had been provided to the operator.
15. No CCTV was installed in the unit.
16. Major damage occurred to electrical/instrument cables, cable tray, light fittings, pipes, flanges, etc. All the six tiers of pipe rack were found affected by fire. Total 22 lines were affected. Six number utility lines (2" and below) were observed sagged and bowed. No sagging was observed in any structure. Total damage (Static + Electrical + Instrumentation) was evaluated around INR85 lacs as per the detailed submitted by the entity.

REASONS OF FAILURE / ROOT CAUSE

Based on the site conditions, statements and incident scene recreation, it was concluded that forklift hit the flow transmitter impulse piping during the backing of the forklift after abandoning the lift operation (without fully lowering the fork) resulting in shearing of the impulse line piping from the root.

The JBO in the pipeline, which was above auto ignition temperature (i.e. 310°C), gushed out and self-ignited, resulting in the fire.

RECOMMENDATIONS

1. Operators of mobile lifting equipment (inclusive of crane/forklift/Farhana) shall have minimum training in line with procedure given in IS13583. A robust mechanism should be developed for competency assessment before deploying the person. As per High Level Committee recommendations (Ref. recommendation 14 of HLC on Baghjan incident)- Competency criteria of key operating personnel shall be explicitly included in tender and to be ensured.
2. Safe work practice shall be ensured as per Cl.7.3 of OISD-GDN-206 like, Identification of anticipated or inherent/ specific hazard in running plant full of hydrocarbon and risk involved should be done through:
    - Systematic evaluation of stepwise activities involved in the non-routine job or it's execution.
    - Identification of possible unsafe conditions in the surrounding
    - Identification of Hazard and risk from other job in the vicinity (if any).

    The TBRA/JSA shall be job specific. It shall identify the hazards, potential consequences, and risks associated with job as per Cl.6.3.1 of OISD-STD-105.
3. Monitoring of critical activities through CCTV with adequate recording facility shall be ensured. Scrutiny of footage manually or through AI techniques should be explored to identify unsafe acts/ conditions and take rectification measures thereof. High-risk activities should be monitored through CCTV in line with Cl.7.10.1(b) of Working Group recommendation.
4. Entity shall review the delayed shutdown initiation.
5. Accessibility to the job site and working space should be assessed and ensured before executing/ conducting the job.
6. Minimum height at lowest point of the bottom most pipe-rack should be stencilled in units for information to all concerned.

7. Periodic process mock exercises should be conducted in process installations for hands on emergency handling experience for asset facing supervisors and workers in line with Cl.7.6.11 of OISD-GDN-206.