CASE STUDY

OISD/CS/2024-25/P&E/02 Dt.: 16/7/24

INTRODUCTION

Title: Fatal accident during hydrostatic testing of fin-fan cooler.

Location: Refinery

Loss/ Outcome: One fatality

BRIEF OF INCIDENT

The injured person (IP) was engaged in hydrotest job of one of the fin-fan air coolers of the under-shutdown Hydro-Cracker Unit of a refinery. The fin-fan cooler platform was at around 14.4 m height. Around 02:00 hrs, a loud sound was heard, and the IP fell from the fin-fan cooler platform. The IP was found lying near the heater area on the ground level, bleeding profusely. The IP was shifted to Occupational Health Centre (OHC). Duty doctor upon checking the IP in the ambulance advised to shift him immediately to the nearby hospital, as the injury was assessed to be very severe (open chest) requiring a specialised treatment (trauma surgeon). The IP on reaching hospital was declared dead.

OBSERVATIONS / SHORTCOMINGS

1. At the time of site visit by the investigation team, the following were observed:
   - The plug (bolt) of the cooler tube was found stuck in the chuck of the pneumatic torque wrench and its thread was intact without any perceptible sign of shearing. The broken wrench (which could be used for both ways, i.e. tightening as well as loosening based on a provided switch) was found at the grade level a few meters away from IP. The pneumatic hose of the torque wrench was still hanging on the air fin cooler platform.
   - The tube threads, whose bolt was stuck in the chuck of the wrench, were found intact, and no sign of shearing was evident implying that it had been opened.
   - Hand railing at the south side of the fin-fan cooler was bent implying that the railing was hit by an object (probably by pneumatic torque wrench) with force.
   - The lighting post facing the fin-fan cooler was distorted, detached and leaning over. The post was probably hit by the IP.
   - Pipeline near the feed filter area at grade level, where the IP fell, were damaged at several places.

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.

- The fin-fan cooler tube bundle had been positively isolated (blinded); hence, no trends of pressure were available in the DCS graphics. A pressure gauge had been connected to the exchanger bundle on north side to see the pressure while hydrotesting.



Pictures of damaged structures/ equipment taken after the incident

2. The log data revealed that some workmen, including those who were on duty along with IP on the incident day, were performing duty for more than 16 hours against the stipulation of State Factories Rules. Introspection/ action by the installation for the contravention of factory rules was not evident.
3. The conditions stipulated in work order specifies that the contractor must ensure relevant manpower to carryout job of this nature. Specific conditions & details of “relevant manpower” were not mentioned in the terms & conditions. Also, the work order did not mention anything about the minimum training requirements or competency of the contract workmen, including supervisor & safety supervisor.
4. Based on the written statement & interaction with the site supervisor, it was informed that he was involved with the contractor since past 12 years and had gained experience by virtue of his involvement with similar nature of works as a site supervisor. During interaction, it was observed that the level of

competency of hazard identification and risk assessment was not up to the mark. No training records could be provided by the contractor.

5. The conditional requirement for deployment of safety supervisor was not met by the contractor on the day of incident. It was also uncertain whether safety supervisor was deployed during other days when the other exchangers (6) hydrotest activity was carried out.
6. As per contract conditions, the entire job was subject to inspection, approval & acceptance by the EIC/ Inspection. Conformance to the above requirement during execution of such critical activities was not evident.
7. Significant lapses in selecting the work permit conditions were noticed.
   - Area cordoned off was marked as "Not Required", requirements of PPE was also casually & randomly selected (marked for "welding suit", "boiler suit", "dust respirator", etc.)
   - No record of toolbox talk & no risk assessment (JSA) had been conducted.
   - No provision of mentioning JSA number in the work permit & the work permit format used was not in line with latest OISD-STD-105.
   - Many criteria as specified in "Standard Procedure for Hydrotesting" were not complied viz. lack of risk assessment and hazards associated with the job, non-barricading of hydrotesting area, test results were not documented, non-revision of standard procedures, non-mentioning of "no repair work/ tightening" during pressurised condition were observed.
8. Another SOP furnished to the investigating team, made specifically for the equipment maintenance job, was in a non-standard format with no information about the review/ approval history, no date of approval, no document related information, etc. indicating that it had been prepared post incident.
9. During interaction with operations/ production personnel, it was informed that the role of shift operations with respect to the activity of fin-fan cooler job was limited to issuing work permits as the equipment was completely isolated & blinded and the entire scope of job was being executed by Maintenance/ Inspection departments.
10. No uniform nomenclature of the equipment was observed. It was also observed during interaction that a sort of non-clarity of equipment identification was existing amongst the workmen & other persons.
11. CCTV coverage during the time of incident was focussed towards other area, where some other maintenance activity was going on parallelly.
12. The FIR provided to OISD was not very clear regarding the cause of accident and indicated an incident of accidental fall implying an occupational accident. However, the accident was more of a process nature, occurring on account of accidental release of high pressure.

REASONS OF FAILURE / ROOT CAUSE

From the fact that the plug was stuck inside the chuck of torque wrench machine, it is conceived that IP attempted to tighten the plug to arrest the sweating (leak) and might have accidently loosened it (The thread of the plug and the tube were intact and there was no sign of shearing) while the equipment was still in pressurised condition for hydrotesting.

Whether the decision to do the task was given by someone or by the victim himself could not be established. It is possible that IP might have been instructed to tighten the plug while the others went to the north side to see the pressure and release it. As there was no means of communication between the other team members and IP (additionally, the gauge was not visible to the IP as he was on other side of the tube bundle), IP might not have known whether the pressure was released or not.

Alternatively, due to the continuous work hours and resultant fatigue, IP might have thought of finishing the job by tightening the bolts.

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.

RECOMMENDATIONS

1. No repair activity shall be carried out while the equipment is pressurised for hydrotest. During hydrotest activity, area around the equipment subject to testing shall be barricaded and unauthorised entry shall be restricted.
2. Standard Operating Procedure (SOP)
   A. Non-standard and non-approved SOPs shall be discontinued.
   B. All SOPs shall be reviewed, revised and approved at least every three years and in accordance with clause no. 7.2.4 of OISD-GDN-206.
   C. SOPs specific to the nature of job should be shared to the executing agency or the agency should be made aware of the practices/ procedures for executing the job in a safe manner as per the methodology described in SOP.
   D. All steps of the approved SOP should be adhered to and any violation should be brought to notice of concerned authority and corrective measure taken. For example, non-availability of additional pressure gauge, during hydrotest activity, should have been reported and corrected.
3. Management should promote all interested parties for reporting of unsafe acts, unsafe conditions and near misses as per clause no.5.1.1(k) of OISD-GDN-206.
4. All the work permit conditions should be verified, conditions to be ensured at the site and then only the work permit to be issued. Organizations should review their work permit system and align with the latest OISD-STD-105.
5. Periodical visit to site shall be ensured by the concerned groups to check the compliance of the work permit conditions.
6. Compliance to the working hours of contract workmen in-line with the state factories rules shall be ensured.
7. 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.
8. Adequate means of communication like walkie-talkie should be ensured during execution of critical activities.
9. First Information Report (FIR) should elucidate all the facts of incident.
10. Hydrotest record shall be maintained in standard format (including the pressure, duration, pressure increment, etc.) related to hydrotesting process for compliance and future reference. Use of chart recorder/ pressurisation chart during hydrotest should be explored.
11. Management shall carry out gap analysis of the safety management system with respect to the working group report and OISD-GDN-206. Necessary corrective actions shall be taken as per the gap analysis recommendations.
12. A committee to carry out gap analysis of contract management system with reference to clause 7.3 of the Working Group Report shall be constituted.

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.