सुरक्षा अलर्ट / SAFETY ALERT

OISD/SA/2025-26/PL/02 Dated: 12/06/2025

Introduction:

Title: Incident during smoke testing of HVAC duct.
Location: Pipeline Station construction site.
Loss/ Outcome: Fire inside the building.

Brief of Incident:

A fire broke out on the 1st floor of the under-construction Electrical Sub-Station Building at one of the pipeline sites. The Sub-Station building housed VFD panels, electrical panels, HVAC ducting, insulating material, cabling etc. The fire occurred during a thermal smoke test for the HVAC duct system, using a fogging machine. Thick black smoke engulfed the first floor of the building, which was emanating from the windows and other openings of the building. All workers were immediately evacuated from the building. Immediate firefighting efforts were started by company personnel using water monitors. Subsequently Mutual Aid partners and the State Fire Service personnel joined in firefighting operation. Through coordinated efforts, the incident was successfully brought under control after around one hour.

Actual site pictures

Observations

- Job specific work permit for smoke testing was not obtained. Permit for work at height was issued for the work in under construction building.
- The incident occurred during the HVAC duct leak test using a thermal fogging machine, which works on pulse jet engine technology. The machine operates by using petrol as fuel and diesel is used for generating smoke. However Electrical Smoke Machine with low toxicity smoke fluid was recommended in Job Safety Analysis for carrying out the job.
- The operator performed three smoke tests within ~19 hours (2 tests on day of incident at 09:00 AM, 11:30 AM and 1 test on previous day at 04:00 PM) for identification and rectification of leakage points in duct, with potentially inadequate purging and ventilation between tests.
- During the final test at 11:30 AM, an explosion and rupture occurred in the HVAC duct (at 3 points), leading to ignition of insulation material and spreading dense smoke.
- Safety Management system at site was found inadequate w.r.t. to following:
    - Absence of fire extinguishers
    - Non-availability of clear work permit documentation,
    - Lack of supervision.
- Standard operating procedures (SOPs), Job Safety Analysis and Tool talk records were available. However, the risk of combustible vapours accumulating within the duct system was not adequately addressed in JSA.

Root Cause

- Combustible mixture formation: Unburnt fuel vapours inside the HVAC duct may have created a flammable atmosphere, leading to the fire.
- Inadequate purging: Successive smoke tests with short intervals may have allowed flammable vapours to accumulate, especially in low-lying duct sections near the AHU unit.
- Use of thermal fogging machine: Petrol and diesel-based smoke-generating agents posed an inherent fire hazard in enclosed duct spaces.
- Failure to detect unsafe conditions: The machine operator may not be aware/identified the risk of combustion.

Recommendations

- Discontinue the use of fuel-based thermal smoke generators and explore alternative testing methods such as optical leak tests, cold-smoke or water-based, non-flammable smoke agents for future HVAC duct testing.
- Training/awareness and competencies of contractor workers shall be ensured so that work is executed safely as per clause No. 7.4 of OISD-GDN-206.
- Ensure the presence of dedicated supervision during high-risk activities.
- Improve fire preparedness by ensuring fire extinguishers are readily available at site.
- Work permits to explicitly mention hazardous activities such as smoke testing with suitable mitigations like LEL testing, extinguisher requirement etc.
- Enhance risk assessment procedures by strengthening existing SOPs and JSA documentation.
- Document and share lessons learned across similar project sites to prevent recurrence.

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