



CASE STUDY

OISD/CS/2020-21/P&E/03

Dt.: 17/02/2021

INTRODUCTION

Title: Fire incident in gas terminal at one of the Indian Gas Processing Plant.

Location: Gas Terminal

Loss/ Outcome: Fire and Explosion, Damage to Installation Assets

BRIEF OF INCIDENT

Formation of extensive HC vapour cloud followed by a fire & explosion took place in the gas terminal of a gas processing plant. The Gas along with certain amount of condensate being received from Offshore fields was processed at the plant. Gas condensate leaked from the condensate metering skid associated with incoming Gas line. No casualty or injury to any person were reported; But condensate facilities /pipelines and structures in the work station were badly damaged under the impact of the fire.

OBSERVATIONS / SHORTCOMINGS

- The leakage originated from the sealing bar of the 6" single chamber orifice meter provided for measuring the condensate flow. Correlation could be established for the orifice meter as the source of leakage based on pressure and flow fluctuations observed in downstream inlet line PT and FT to CFU.
- Six days before the incident, there was leakage from the same orifice meter. Repairing was done by replacement of O-ring on the same day. O-rings were not procured from OEM and there was no record of past POs or shelf life of the item. The investigation team could not establish the traceability and genuineness of the O-ring for assessing its integrity.
- The job of replacement of orifice meter O-ring was carried out without any set/ written down procedure; No investigation was conducted for the incident of leak from the said orifice meter 6 days earlier.
- Fasteners used in the failed orifice meter were not of standard design; It had different fasteners on the side, where the nuts got dislodged. On the other side, 02 fasteners are partially threaded and 02 fasteners are full threaded. The standby orifice meter had all the fasteners full threaded. Original design of the fasteners could not be established as drawings were not available.
- There was no provision for remote operation of the MOVs installed in pipeline header as well as metering skid.
- HC Gas detector and one H₂S detector were available in the area of leakage. No logging /history record of the Gas detectors was available in the control room.
- Localized Emergency shutdown (ESD) concept was not available.

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.

- Two pipe lines got dislocated and were in hanging position due to failure of supports. Preliminary observation showed there was no fire proofing provision for the steel truss supports.



Source of leak



Vapour Cloud



Fire incident



Incident Severity

REASONS OF FAILURE/ ROOT CAUSE

- Loss of primary containment (LOPC) due to use of nonstandard spares during maintenance of the orifice meter.
- The immediate cause of failure of orifice meter was O-ring failure resulting in condensate leakage through the orifice sealing area under high pressure. Improper clamping of sealing surface (Bolts/ studs found loose) and / or use of non-standard O-ring might have contributed towards the cause of failure. Failure of O-rings due to gradual loss of clamping pressure was a possible scenario.
- Delayed detection of the leakage.
- Delayed response to isolate and depressurize the hydrocarbon circuits. Emergency shutdown system was not available.
- Inadequate automation of Fire & Gas detection and Emergency Shutdown system (ESD).
- Integrity of flame proof lighting and associated fittings were not ensured. Electric power, which may act as ignition source for HC vapour cloud, was not cut off after formation of the HC vapour cloud.

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 confirmed source of ignition could not be established; but looking at the fire propagation direction and damaged condition of one of the nearby lamps, the said lamp was suspected to have acted as the ignition source for the vapors cloud. The cage of the lamp was found broken from the joint.



CONCLUSION

From the above analysis, it is concluded that the immediate cause of the fire was the result of formation of vapor cloud near the incident site due to leakage (and vaporisation) of gas condensate from the orifice meter and possible ignition from a damaged/ broken lamp cage.

RECOMMENDATIONS

- Only genuine and standard parts from OEMs to be used for the pressure equipment.
- SOP shall include normal operation, start up and shut down procedure with responsibility for each activity. Relevant SOPs to be reviewed, signed by competent authority and same shall be made available in the Control Rooms and to concern officials.
- Standard Maintenance Practice (SMP) to be developed as per manufacturer's operation and maintenance manual and to follow it religiously during maintenance jobs.
- Root cause analysis to be carried out for all type of equipment failure and corrective action as recommended shall be implemented horizontally in all other similar equipment.
- Integrity of flame proof lighting and associated fittings to be ensured.
- Electric power, which may act as ignition source to be cut off after detecting leak / HC Vapor cloud.
- All the incidents including LOPC irrespective of minor or major, should be reported and root cause analysis to be done to eliminate the cause and identify the preventive /corrective actions to avoid major incidents in future. As per clause 4.12 of OISD-GDN-206, every incident and near miss incident must be recorded and thoroughly investigated.
- Automatic shutdown (ESD) facility is to be provided in case of Gas detection and Fire detection and necessary surge analysis to be carried out.
- Study on Fire fighting system adequacy including Fire / Gas detection system to be done and identified gaps to be bridged in a time bound manner.
- Requirements of fire proofing of structural members to be re-evaluated in line with OISD-STD-164 and implemented for process area, as per requirement.
- Trainings on Emergency Response plan to be conducted. Disaster drills need to be carried out periodically to enable faster and more effective response from the concerned personnel.

)))XX(((

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.