

OIL INDUSTRY SAFETY DIRECTORATE
NOIDA

CASE STUDY

M.O (Onsite)

No. 17/01

INTRODUCTION:

Title: **Fire incident in Carousel at LPG Plant**

Location: **LPG Filling shed**

Activity Type: **Cylinder filling**

Result/ outcome: **Fire. No injuries or causality were reported.**

THE INCIDENT:

- ❖ Major fire incident took place at carousel in one of the LPG Bottling Plant.
- ❖ A metallic guiding hook is provided on filling machine through which the filling hoses are passing for connecting to filling guns. Due to latching/ de-latching movement of filling guns in each filling operation, outer braiding of LPG hoses got damaged due to rubbing with metallic guiding ring and became weak at that particular area.
- ❖ LPG leak occurred due to probable bursting/ damage of that particular weakened portion of LPG hose of filling machine.
- ❖ LPG leakage caught fire due to static charge.
- ❖ Since the fire was not extinguished at initial stage, the size of fire was sufficient enough to damage the LPG hoses and LPG cylinders of adjacent filling machines.
- ❖ Duration of fire was approx. 65.min.

ANALYSIS:

- ❖ Fire starts at about 20:35. One contract employee at the inlet of carousel and another permanent employee little away from carousel reported seeing the fire. No gas leak is seen by any of these persons.
- ❖ From the intact 17 nos. Filling machines, it is seen that the LPG hoses are damaged near guide ring during movement in every filling operation. Only few LPG hoses were replaced since commissioning of the carousel and the rest are beyond useful life. Source of leak is from bursting of hose. There is no gas stop valve at the junction of the distribution pipeline and hose which could have prevented further leakage.
- ❖ Major breakdown in carousel when tripod below carousel was broken. Tripod was welded and carousel was restarted. For this repair work, all Filling Machines were removed, earthing cable of individual filling machine removed and carousel frame was raised by jacks. Source of ignition is static electricity which may have generated due to not fitting of earthing cables properly after the major maintenance.

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- ❖ One monitor seems to have been directed at the fire on carousel on the intact 17 nos. filling machines - no BLEVE of cylinders in these filling machines observed.
- ❖ Mock drill has not been conducted above the carousel for more than 2 years. The devastation of carousel and the BLEVE of cylinders point to that the sprinkler over the carousel has not operated from beginning.
- ❖ ROV on the LPG inlet line to carousel has not closed automatically on actuation of ESD and Break Glass buttons provided at unloading finger.
- ❖ Deluge Valve over carousel did not operate on actuation of break glass buttons provided at unloading finger. Probable reason for this may be isolation valves of this Deluge Valve might have been kept closed to avoid water sprinkler operation on carousel during mock drills/ routine testing of sprinklers.
- ❖ The 17 intact filling machine containing half-filled cylinders are a stark contrast to rest of the devastated carousel. These 17 filling machines and the cylinders in them are unaffected due to the monitor pointed at them and locked into position.
- ❖ There are total 4 deluge valves in the filling shed, other three deluge valves operated properly since there is no other major damage in the LPG shed area.
- ❖ Firefighting system provided in the plant could not be effectively utilised at the initial stage by the available HPCL employees. Fire extinguished only after supply of LPG exhausted i.e. body valve of the ROV on the LPG inlet line to carousel was manually closed or LPG in the pipeline between carousel and LPG pump house was totally burnt.
- ❖ All around road behind the LPG shed (as recommended in OISD-STD-144) is not available hence fire tender was used from distance.
- ❖ Roof of the shed above carousel area was badly damaged which indicates that pieces of busted cylinders might have fallen out of LPG shed.

REASONS OF FAILURE/ ROOT CAUSE:

- ❖ LPG hoses of the Flexspeed carousel filling machines have not been replaced since commissioning of carousel. Clause 7.5 of OISD-STD-135 states that LPG hoses have to be discarded after every three years of service or earlier in case the permanent elongation exceeds 5%.
- ❖ A metallic guiding hook is provided on filling machine through which the filling hoses are passing for connecting to filling guns. Due to latching/ de-latching movement of filling guns in each filling operation, outer braiding of LPG hoses got damaged due to rubbing with metallic guiding ring and became weak at that particular area and became source of leakage of LPG due to bursting of hose.
- ❖ Source of ignition is probably static electricity which may have generated due to improper fitting of earthing cables after the major maintenance of carousel.
- ❖ Non operation of sprinkler system over Flexspeed carousel. Plant had not carried out mock fire drill on this carousel since commissioning.

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- ❖ Non-closure of ROV on the LPG inlet line to carousel on actuation of Emergency Shut Down (ESD) as well as Break Glass buttons for actuation of Deluge Valves.
- ❖ Poor maintenance of Flexspeed carousel and delay in attending the maintenance issues like filling gun leakages, carousel inlet /outlet problem etc.

MAJOR RECOMMENDATIONS:

- ❖ Replacement of LPG hoses being used in the plant at various facilities in line with clause 7.5 of OISD-STD-135.
- ❖ Whenever earthing connections are removed for maintenance of filling guns/ filling machines, electrical continuity of such filling guns/ filling machine should be checked, ensured and recorded appropriately before re-commissioning.
- ❖ Mock fire drill should be conducted periodically covering all risk scenario as per Quantitative Risk Assessment (QRA) and ERDMP including carousel area at least once every year to check readiness and constraints (if any) for all possible exigencies and record maintained.
- ❖ To ensure that carousel provided in LPG Plants are meeting the weather proof (IP Protection) requirement to take care of sprinkler, monitor and hydrant water spray during mock drills and any exigencies.
- ❖ To ensure that while maintaining the record for testing of various safety systems (ESD/ DVs etc.), all the safety trip provisions available should be checked and recorded.
- ❖ PLC based logging (with printing option) of firefighting system (Deluge Valve operation, ESD operation, MCP operation, Fire Pump operation etc.) should be ensured.
- ❖ Manual logging of events w.r.t. operation and maintenance of safety systems, critical equipment's in shed, LPG Pump House and Fire Water Pump House should be ensured in the log books maintained by the person who is actually performing the jobs and same is reviewed by the concerned officers and signed.
- ❖ CCTV should be kept functional at all times.
- ❖ To review the internal safety audit system to ensure compliance/ action taken of previous safety audits are thoroughly reviewed during subsequent internal audits.

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