केस स्टडी / CASE STUDY

OISD/CS/2021-22/LPG/05 Dt.: 31/12/2021

INTRODUCTION

Title: Fatal incident during degassing process of 150 MT capacity above ground LPG storage bullet

Location: LPG Bottling Plant

Result/ outcome: Two fatalities

BRIEF OF INCIDENT

The incident took place on 150 MT capacity above ground bullet no. 3 during degassing process. Degassing of this bullet was being carried out for replacement of Magnetic Level gauge by Radar gauges.

Plant had obtained PESO approval for replacement of magnetic level gauge with radar gauge on 3x150 MT above ground LPG Bullets. Detailed procedure/ SOP was mentioned on PESO approved drawing. Hot permit was issued by plant manager to maintenance officer.

Work for replacement of gauge on bullet no. 1 was completed and bullet no. 1 was re-commissioned and put in use. For replacement of gauge, degassing of the bullet was not done and also before re-commissioning of bullet no. 1, hydro test was not done.

Emptying out of LPG from bullet no. 3 was started for replacement of gauge and vapour recovery was also completed. De-pressuring was done from the isolation valve of the Safety Relief Valve (SRV), after removing the SRV. Magnetic Level gauge was removed without degassing the bullet. After removal of Magnetic Level gauge, it was observed that both the floats and spring were detached from the rod and did not come out along with the rod. In anticipation that the two floats may in future get stuck/ obstruct the LPG liquid bottom line, it was decided to remove the floats from inside the bullet no. 3 and for this degassing of the bullet was to be done.

For degassing of bullet no. 3, fire hose was connected from one Double Hydrant at water drain point of bullet no. 3, through a spool piece having male part for hose connection. To speed up the water filling for degassing of bullet no. 3, another fire hose was connected from another Double Hydrant up to the top of bullet no. 3 for water filling through manhole. For this purpose, top manhole was opened and both the deceased person in presence of HSE officer tried to hold/ fix the fire hose in manhole and in this process one person fell inside the bullet and second person went inside the bullet to save first person.

Plant personnel tried to rescue these two persons but due to lack of oxygen inside the bullet, small size of manhole (460 mm internal dia) and non-availability of appropriate equipment for rescue in such condition, no one could enter inside the bullet.

Emergency was declared by the plant and mutual aid members and local district administration were informed. Later State Disaster Response Force (SDRF) and National Disaster Response Force (NDRF) were also called. With the help of blower brought by one industry (other than oil companies), LPG vapour was pushed out from the bullet to increase the oxygen level and both the dead bodies were taken out from the bullet by NDRF personnel.

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OBSERVATIONS/ SHORTCOMINGS

1. **Non Compliance of Standing Operating Procedures (SOP): -**

   a. Procedure to be adopted for this work (without any hot work on bullet) was mentioned in the drawing approved by PESO and was prepared and submitted by the plant and approved by PESO. Following major steps that were clearly mentioned in the approved SOP/ procedure, were skipped during job execution:

      i) Degas the bullet by filling water inside it from bottom liquid in/ out connection.

      ii) Check LEL and Oxygen level (O_2) inside bullet and if within limit make vessel entry with FLP lighting.

      iii) Clean the bullet from inside, collect the sludge.

      iv) Conduct hydro test of bullet with new spool piece at pressure 28.857 kg/cm2.

      v) Purge the Bullet with LPG vapour drain water from bottom of bullet.

      Above activity at S. No. i), ii) and iii) was to be carried out before removal of Magnetic Level gauge and installation of new Radar gauge. Activity iv) was to be carried out before re-commissioning of bullet as newly fabricated reducer/ spool piece was installed at first flange joint.

   b. All above major steps i.e. a. i), ii), iii), iv) and v) were skipped during level gauge change job for bullet no. 1, with the mutual consent/ understanding between the contractor supervisor and plant officers. Similar planning for job execution was there for bullet no. 3 and so step no. a. i), ii) and iii) were skipped for bullet no. 3 job and subsequently the accident happened.

2. **Lack of supervision by plant personnel and Contractor: -**

   a. Clear role and responsibilities of plant officers and staff as well as contractor personnel for critical activities of this job was not defined by location in-charge, due to which the supervision of jobs at field level was inadequate.

   b. Permit receiving officer and contractor supervisor/ personnel were not present at site at the time of incident.

   c. Job which was supposed to take minimum 4-5 days for each bullet, if proper procedure had been followed, was completed in hurry in only 2 days for bullet no. 1 by bypassing critical steps of PESO approved SOP.

3. **Non-compliance of Work permit system: -**

   a. Hot Work permit was prepared for replacement of Magnetic Level gauge by Radar gauge on bullet no. 1, 2 and 3. Approved copy of Job Safety Analysis (JSA) for change of level gauges was not available at the LPG plant. Job Safety Analysis (JSA) attached with the Hot Work permit was for another job related to SRV testing/ GMS testing/ welding work. There is no record of Tool Box Talk with the two deceased labours.

   b. Work permit conditions were not filled correctly e.g. #7 - Equipment properly steamed/ purged - not required, #8 - Equipment Water flushed - not required, #11 - Gas test done have been shown and 20.9% of oxygen level and 0% of hydro carbon have been mentioned. Conditions of entry to confined space have not been correctly filled and no lack of oxygen and non-availability of combustible gases have been shown, whereas bullet no. 3 was having lack of oxygen and availability of combustible gases at the time of start of degassing process through water filling on the day of incident.

   c. Hot Work Permit was received by maintenance officer; however, he was not present at site during water filling process of bullet no. 3 for degassing. Also contractor supervisor was also not present at site. He was out of plant at the time of incident. Only safety officer was present at the site along with two deceased contract labours.

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d. In the work permit extension, brief detail of work was mentioned for that particular day. However, correct/ actual work details were not mentioned, e.g. purpose of permit extension on the day of incident was mentioned as “Depressurisation of bullet no. 3”. Jobs being performed or to be performed in field on the day of incident such as Degassing, removal of Magnetic Level gauge, installation of Radar gauge, opening of top manhole etc. were not mentioned in the permit extension detail.

4. Emergency handling response:

Rescue operation could not be done in time due to non-availability of proper equipment for safe entry in vessel (having LPG vapour or lack of oxygen) through manhole (460 mm internal dia). Location itself tried to rescue the deceased, but personnel were unable to enter the vessel through manhole carrying breathing apparatus, due to restriction faced by large size of BA to pass through the manhole. Call to mutual aid members for emergency/ rescue was made after a delay of more than one hour.

5. Lack of exposure/ proper training to Officers:

HSE officer who was present at site at the time of incident joined the company 4 years back and he joined this location three month back only from other function and this was his first posting in LPG. He has not undergone training on ‘Safety & Standard Operating Procedures (SSOP)’ as per company policy.

6. Recording and review of log books/ dip book:

a. Each bullet is having two level gauges i.e. Rochester gauge and Magnetic Level gauge, however reading of only Rochester gauge is being entered in the LPG Pump House dip book. Magnetic Level gauge of bullet no. 3 was not working and reading of the same was not being recorded in dip book. Plant is not aware since when this gauge was not working.

b. Factual and true record of events/ instrument readings in field log books, were not found maintained by the field staff. Review of the field logbooks was not being done by plant officials on regular basis.

c. It was mentioned in the Fire Water Pump House logbook, that Fire Water Pump no. 2 was started to fill bullet no. 1 with water. But in reality, bullet no. 1 was not filled with water.

d. Name and signature of personnel on duty in Fire Water Pump House was not found recorded in the logbook. So, it is difficult to find out who has made entries in the logbook or who was on duty in FWPH in any particular shift/ day.

e. Status of various activities w.r.t. the job of level gauge change in LPG bullet no. 1 and 3 was not found mentioned in the LPG Pump House logbook.

7. Non-compliance of Access control/ gate pass systems for personnel: -

a. Personnel entry/ exit at plant gate is not being controlled and entered in gate registers. Contractor supervisor left the bottling plant on the day of incident without making any exit remarks in the register kept at the main gate. He again entered the bottling plant without making any entry in the register. Incident took place during this period only.

b. On the day of incident there is no gate entry including arrival time of mutual aid members and district administration.

c. As per record provided by plant, photo passes were issued to both the deceased labours. However, signature of issuing officer/ plant in-charge is not available on plant record/ register.

d. Purpose of labour/ contractor entering the plant on any particular day was not found recorded/ approved. Plant officials were having no record as to why and for what job the two deceased personnel were allowed to enter the plant on the day of incident.

8. **Management of Change (MOC)**: Administrative approval is available for replacement of Magnetic Level gauge by Radar gauge. However, MOC (Management of Change) was not obtained by the plant for same.

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REASONS OF FAILURE/ ROOT CAUSE

Non-compliance of Standing Operating Procedures (SOP) by location personnel and contractor is the root cause of this incident.

CONCLUSION

The incident took place due to non-compliance of PESO approved SOP, lack of supervision and short cuts adopted to complete the work in hurry.

RECOMMENDATIONS

The recommendations are as follows:

1. **Compliance of SOP:**

   a) In view of this incident, existing procedure for degassing, hydro testing and commissioning of Bulk LPG storage vessels (Above ground bullets, spheres and MSVs) to be reviewed and revised detailed procedure to be circulated to all LPG installations and compliance to be ensured. This procedure may be made part of tender for such jobs as “Typical Procedure”.

   b) Adherence by officers, staff, contractor/ contract worker to the SOP for various plant operation/ maintenance/ periodic testing etc. to be ensured by the location In-charge with “Zero Tolerance”.

2. **Effective Supervision of works:**

   Effective supervision to be ensured while executing any critical maintenance/ periodic testing etc. Role and responsibility of officers, staff and contractor to be clearly defined. Job activity chart should be prepared and approved by location In-charge.

3. **Work permit system:**

   Strict adherence to work permit system as per OISD-STD-105, which includes:

   a) Conditions of work permit should be filled correctly in line with the SOP and nature of job to be carried out.

   b) Appropriate JSA and SOP should be attached with work permit depending of actual nature of work. Tool Box talk to be carried out shift wise/ daily with persons involved in the job.

4. **Training:**

   a) Transfer of officer from one function to other function is common HR practice. Whenever any officer is transferred to new function, adequate training/ work knowledge should be imparted within specified time period and record to be maintained.

   b) For new officer and officers joining on lateral transfers from other functions, structured induction training of minimum one week, at the new location, to be considered.

5. **Logbooks:**

   a) To ensure logging/ entry of daily activities and sequence of operation performed in the log book of respective area where maintenance work is being carried out.

   b) Logbooks should be reviewed and countersigned by the role holder officer on daily basis.

   c) Reading of both the level gauges provided on LPG storage vessels should be recorded in log book/ dip book irrespective of which gauge reading is used for stock accounting purpose.

6. **CCTV Camera and GMS Sensors:**

   a) To review and ensure that, adequate number of CCTV cameras are installed at all LPG Installations to record critical maintenance activities. While issuing the work permit for such critical works, detail of CCTV cameras and GMS sensor number covering that work place and working condition of same to be entered in the work permit.

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b) There may be some instance where CCTV cameras and GMS sensors may not be available to cover critical maintenance activities. To take care of such instance, locations to explore the feasibility of providing portable CCTV camera and GMS sensor.

c) CCTV should have provision of recording with “date and time” data on screen for ease of analysis/ review.

7. Contractor/ TPIA responsibility:

Should take up appropriately with the contractor for SOP violations and also with PESO for violation of SOPs by PESO approved TPIA.

8. Equipment for vessel entry as well as rescue

Rescue operation could not be done in time due to non-availability of equipment for safe vessel entry (having LPG vapour/ lack of oxygen) through manhole (460 mm internal dia). To provide suitable equipment such as hose mask with hand operated blower/ Supplied Airline Respirator system and full body safety harness with double lanyard, for safe vessel entry. Same to be used at the time of vessel entry even after degassing of vessels during periodic testing/ any other maintenance work.

9. System for ensuring proper and timely Emergency Response

a) In view of this incident, on site/ off site mock drills should be conducted for such emergency scenario involving mutual aid members and district administration as per ERDMP guidelines. Corrective action to be taken on observations made during the mock drill.

b) In case of any major incident, internal investigation team should evaluate emergency response done by the respective location w.r.t. ERDMP guidelines.

10. Access Control System-

Access Control System should be strictly ensured at main gate and entry gate to licenced area, to ensure entry/ exit time of each personnel is recorded. Considering the seriousness of this issue, company to formulate the policy including formats of Gate Registers to be maintained and ensure the compliance of same.

11. Other Recommendations-

Bullet no. 1, which was not hydro tested after fixing of Radar Gauge, should be hydro tested immediately as per procedure/ SOP approved by PESO. Also plant to ensure that reducer spool pieces installed for fixing the radar gauges is fabricated by PESO approved fabricator, as per approved SOP. Also first fitting on bullet nozzle should be isolation valve, thereafter reducer & radar gauge to be installed.

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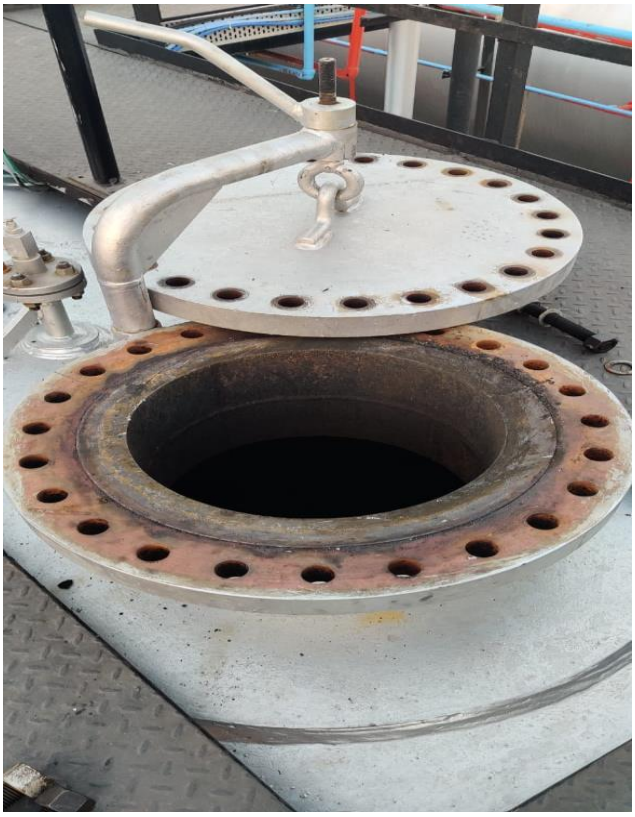
MANHOLE OF BULLET (460 MM INTERNAL DIA)



LADDER OF BULLET REMOVED FOR TAKING OUT THE BODIES



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HOSE CONNECTION FOR WATER FILLING IN BULLET THROUGH WATER DRAIN LINE



LEFT (MAGNETIC LEVEL GAUGE) RIGHT (DEFECTIVE MAGNETIC LEVEL GAUGE)



TOP OF BULLET

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