

CASE STUDY

OISD/CS/2020-21/POL/01

Dt.: 20/05/2020

INTRODUCTION

Title: Fire Incident due to leakage of MS from insulating flange joint.

Location: POL Terminal

Loss/ Outcome: Product and Production Loss / Injury to one person

BRIEF OF INCIDENT

A fire incident took place at one of the Terminal during the pipeline receipt of MS from Refinery. At the time of incident, MS pumping was going on from Refinery to Terminal at the rate of approx.800 KL/hr., length of the line is approx. 4 KM and line fill quantity is 1050 KL.



Flange, the point of leakage



Piping inside the terminal

MS pumping from Refinery to Terminal started in the morning. The fire incident took place in the afternoon near the insulation joint provided in 24" MS line when it comes out of the ground inside the Terminal. The Pipeline from Refinery is coal tar coated and provided with Cathodic Protection (CP). To isolate this pipeline from station piping, insulating gasket was provided just after raising from underground section inside the Terminal. During the receipt, no job was going on or near the site of incident except the wagon loading of ATF. The CCTV camera provided near the site was not working. The fire was first noticed by the contract worker who was loading ATF rake in the siding. He alerted Control Room and all on VHF and started to fight the fire. Control Room advised Refinery to stop the pumping and also communicated all the coordinators involved in firefighting response. The firefighting continued for almost 4 hours. Due

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to continuous leakage, fire reignited twice in the area and was finally brought under control by evening through combined efforts of all members of offsite disaster management group.

As minor product leakage was occurring from insulation flange, flushing of the pipeline was started from Refinery end. Once the line was filled with water, tightening of the flange was done using non-sparking tools and leakage was completely arrested by mid night. During the firefighting operation, one employee of the Refinery was injured due to fall from foam tender.

OBSERVATIONS / SHORTCOMINGS

1. Insulating flange gasket was used in the pipeline instead of monolithic insulating joint. Insulating flange gasket and insulating sleeve on studs are susceptible to weathering and deterioration
2. Refinery is the owner of pipelines supplying products to Terminal and further to Jetty area through the installation. The integrity assessment through hydrotest, CIPL / DCVG surveys and PSP readings measurement & monitoring was being done by Refinery.

Lack of system was evident in carrying out the monitoring of piping inside the Terminal on regular basis. Confusion was there w.r.t ownership of the pipeline and piping inside the Terminal. Only the major periodic assessments like PSP monitoring, CIPL/DCVG survey, ultrasonic thickness of above ground piping and pressure testing was being taken care by Refinery. The condition monitoring of above ground portion of pipeline including insulating flange joints to check the possibility of minor leaks, vibrations, possibility of spark across insulating flange gaskets etc. was not done and recorded to rule out these conditions in routine operations and getting prior information before failure of any component involved in the system.

3. No pressure monitoring instrument was installed at pipeline dispatch and receipt location which could indicate possibility of leakage prior to reporting of fire incident.
4. Flow monitoring and reconciliation was based on tank dip at both the ends. There was no online flow monitoring system for giving any alarm on any abnormal flow conditions such as leakages.
5. Hydrocarbon detector was not installed at the incident location within the Terminal which would have given any indication on the leakage and thus allowing any proactive measure before the fire incident.
6. Insulating flange joint was provided without any consideration of upstream isolation valve causing delay in controlling the leakage
7. CCTV camera covering the fire site was non-working for last three months. Further, the location was having PTZ camera which was not focused on the incident site even after the occurrence of incident for its monitoring from the Control Room.
8. The integrity assessment of the pipeline and flange joints in the line is based on hydro test at an interval of 5 years. The hydro test was done in December, 2015 by Refinery. The hydro test report was indicating a test pressure of 12.0 Kg/cm² held for 20 hours. However, hourly record of pressure measuring instrument/ pressure recorder was not in place to confirm integrity of pipeline including the flange joints.
9. The Off PSP readings in some of the test points observed to be in under protection range as per quarterly CP monitoring reports. The unprotected side reading at the insulating joint was observed to be on higher side which is indicating leakage of CP current across flange joint.
10. Surge diverter was not provided across the insulating joint.
11. Earthing was not provided at the insulating flange joint which might have allowed build-up of static charge.

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12. The CIPL survey data indicated under protection in most of the pipeline length based on off readings. However, no section was selected for DCVG and coating repair. Further, only the graph of the readings was available without any record of readings in the pipeline section.
13. The automation job of the terminal was not complete. The events log to confirm the closing of tank ROSOVs, start of fire engines etc. were not recorded at the time of incident.
14. The sharing of signals for Pipeline Transfer (PLT) and hotline communication was not working between the Terminal and Refinery. The OFC link provided by Refinery for pipeline transfer between them got damaged almost a year back which has not been restored till date by Refinery. Only P&T and mobile communication was working between Terminal and Refinery.
15. The firefighting response of Terminal was not satisfactory. They could not contain the fire in initial response as they failed to maintain the continuous foam supply for making foam blanket on fire site resulting in spread of fire. Later on also, they were not able to take the lead in containing the fire and the situation could be brought under control mainly by Refinery team and their resources
16. There were gaps observed in emergency response of the Terminal and Refinery. The Refinery was not part of Mutual Aid Response Group (MARG) though it was under the same organization. The initial information to Refinery about the fire incident was given by Terminal and also for stopping the dispatch pumps. However, Refinery restricted itself to shutting down the pumping operation. No further proactive effort was made by Refinery to get the details of the incident. They took serious note of the incident only after getting information from state authorities which shows lack of proper coordination. The fire tender of Refinery could reach the site 15 minutes after the first fire tender was reported at the site from State fire services, Then Refinery fire team could take the charge of situation. Further, it was observed that person manning the Control Room activities could not confirm the nature and magnitude of fire which delayed the selection of fire tender for firefighting exercise.
17. One officer of Refinery got injured during the firefighting exercise. He slipped and fell from the roof top of fire tender, possibly due to the slippery roof (due to foam and water presence) or may be due to movement of monitor.
18. Audit system of the Terminal as well as of Refinery was not adequately covering various operations, maintenance and inspection aspects of product transfer pipelines and adoption of best engineering practices. Various gaps like non-availability of pressure monitoring system, flow monitoring, non-availability of hydrocarbon detectors, coating issues in pipeline etc. were never pointed out in internal audit system.
19. Management review of Terminal and Refinery was not included pipeline related issues, exchange of pipeline data, pumping / receipt tank data, communication between Terminal and Refinery etc.

REASONS OF FAILURE / ROOT CAUSE

Profuse leakage of MS from insulating flange gasket, most likely due to ageing of sleeves leading to failure of grip at flange joint, and generation of spark due to release of accumulated charge with MS resulted in immediate fire

RECOMMENDATIONS

1. Insulating type flange joint shall be replaced by monolithic insulating joint.
2. Earthing of the pipeline and piping system shall be ensured at insulating type flange joints to avoid charge build up in case of PLT operation. The earthing is really important at all the potential leak points to avoid generation of spark due to static charge dissipation. Further, surge protection device shall be provided across insulating joint.

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3. Visual inspection of all above ground portion of pipeline including the flange joints must be strengthened for any signs of leakages, vibrations, dislocation etc. due to the effects of various operating factors like thermal expansion and weathering actions.
4. The online pressure and flow monitoring instruments at the dispatch side and pressure monitoring instrument at receipt side of the pipeline shall be provided for confirming the normal pipeline operation.
5. Hydrotest of the pipeline must be done with utmost care. All the pressure and temperature variations must be recorded. All the possible points of minor leakages like flanges, valves etc. must be checked closely for any signs of deterioration of compressible parts like gaskets, sealing glands etc.
6. The flange joint in any pipeline should be provided only after welded isolation valve to facilitate offline maintenance activities like replacement of gaskets and for effective emergency response in case of any such leak/fire incident in the Terminal.
7. Hydrocarbon detectors shall be placed in the Terminal in such a way that all the piping and process area is adequately covered for early warning in case of a leakage.
8. Risk assessment of the Terminal shall be done covering various aspects of pipeline operations as lot of underground pipelines are passing through the Terminal. All the hazards shall be identified and proper remedial measures shall be implemented for mitigating these risks.
9. Internal audit system of the Terminal and Refinery shall include the pipeline system also. The internal audit of pipelines by Refinery shall be done by engaging competent persons dealing with various issues in pipeline system for adopting best practices based on latest developments and previous industry experiences. All the gaps like inadequate CP, earthing issues, absence of surge protection measures shall be checked and attended immediately.
10. Management review mechanism shall be made more robust in the terminal & Refinery for attending important issues like exchange of critical pipeline & tank data between Refinery and Terminal, communication link issue, close coordination between Terminal and Refinery etc. Periodic joint meetings should be conducted between the top management of Terminal and Refinery for resolving any pending issues.
11. Emergency Response and Disaster Management Plan (ERDMP) shall be revised by both the Terminal and Refinery considering the interaction of processes at Refinery and Terminal which can have bearing on the safe operations and emergency response. The role of Refinery is significant for controlling any kind of emergency and joint mock drills should also be conducted for improving the coordination between Refinery and Terminal. The response of Control Room should be improved in emergency handling for ensuring effective external communication.
12. Firefighting system of Terminal shall be strengthened for developing independent capability in controlling such kind of possible emergent situations with their in-house resources.
13. Automation jobs in the terminal shall be completed on priority. All the events must be logged in the PLC server for proper analysis and control of all operations. All the critical events shall be backed by proper voice and visual indications.
14. The availability and CCTV system must be enhanced for better monitoring of all facilities within the Terminal. Further, strategic use of PTZ cameras must be given importance in close monitoring and control of critical activities from Control Room.

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