केस स्टडी / CASE STUDY

OISD/CS/2025-26/MOPOL/20 Dated: 15/01/2026

INTRODUCTION

Title: Fire Incident at Above-Ground Ethanol Storage Tank During Receipt Operations

Location: POL Installation

Loss/ Outcome: Tank Damage. **Injury/ Fatality**: Nil

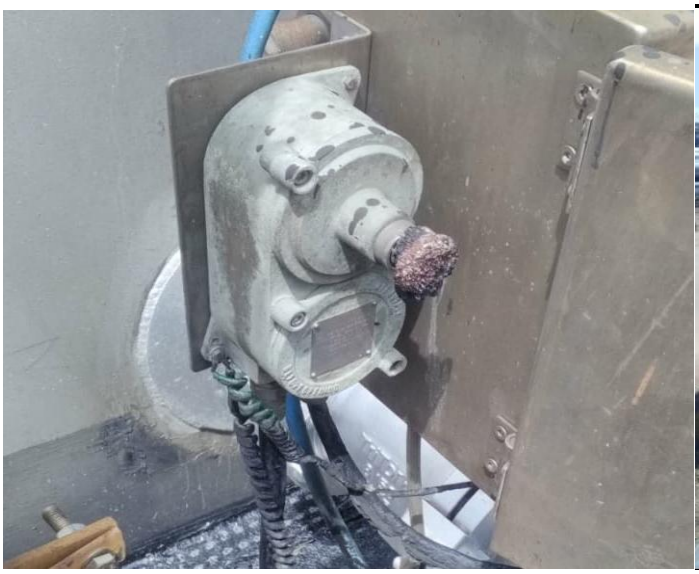
INCIDENT

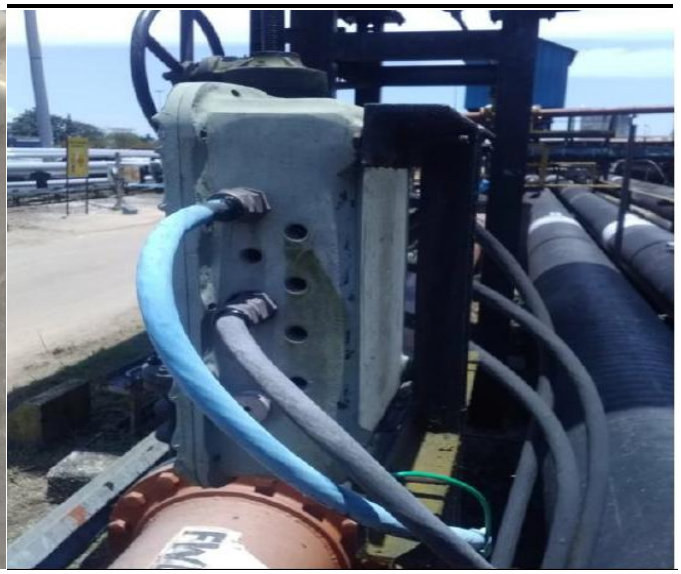
During an unloading operation of ethanol from tank trucks to AG fixed cone roof tank, a loud noise was heard followed by a fire. As a result of the accident, the tank was momentarily lifted off its sand foundation before settling back down, and the roof was horizontally displaced by approximately one meter. Multiple jet fires erupted from the 1-inch thermal expansion line connected to tank, while ethanol dripped onto the ground from the ruptured pipeline, which caused the fire to spread to the tank inlet ROSOV and its associated cables. The combined spill and jet fires continued for approximately three minutes.

OBSERVATIONS

- The PV valve size was modified from 150 mm to 75 mm to install a silica gel trap and flame arrestor, but venting adequacy calculations were not performed.
- Ethanol unloading pump capacity was increased from 100 KL/hr to 150 KL/hr without conducting any design calculation study.
- Valves on thermal expansion lines, between the ROSOV and MOV and before the MOVs, were kept open during unloading operations, which violated the SOP.
- Maintenance and inspection records for the expansion line were not available.
- The explosion occurred due to abnormal vapor pressure buildup in the tank. The tank and its bottom plate momentarily lifted, severing anchor bolts, before settling back. Subsequently, the shell-to-roof frangible joint failed, displacing the roof horizontally by about 1 meter. The top hand railing broke at multiple locations, the rooftop platform was damaged, and stairway grating with its support structure fell to the ground.
- All rooftop appurtenances were displaced or damaged. The dip hatch housing assembly, PV valve mounting assemblies, and HLS assembly were observed leaning in the same direction.
- The concrete ring beam foundation of the tank was fractured at multiple points.
- Of 17 anchor bolts, 10 were damaged and 2 were missing. Several bolts were severely corroded and thinned out. Anchor bolts were not checked during the last inspection.
- The tank had three earthing points, two taken from anchor chairs instead of using austenitic stainless steel grounding lugs on the shell.
- Earthing cables of rooftop instruments were found hanging along the stairway.

- Earthing bonding jumpers were not provided at multiple flange joints of MOV and ROSOV in the tank inlet pipeline.
- Inlet ROSOV and MOV cables were damaged by fire. The push button and indicator cover mounted on the ROSOV were also fire-damaged.
- The fixed foam pourer feeding pipeline was disconnected inside the dyke for modification work while the tank was in normal operation.
- Several flameproof enclosures inside and outside the tank dyke had compromised flameproof integrity.





ROOT CAUSE

- Modifications to the PV vent design and changes in receipt flow rate were made without recalculating venting adequacy. The added silica gel trap and flame arrestor likely restricted the P&V valve capacity, causing abnormal vapor pressure and tank explosion.
- Post-explosion, the frangible joint failed, displacing the roof and damaging appurtenances, including the expansion line. This led to ethanol spillage, with probable ignition from metal-to-metal friction, allowing fire to spread from the tank top to the bottom manifold.
- Roof displacement also ruptured the 1-inch expansion line at multiple points, spilling ethanol over the inlet ROSOV and into the manifold area. Compromised FLP enclosures inside the dyke (ROSOVs, MOVs) resulted in ethanol vapors igniting.

RECOMMENDATIONS

- Adequacy of tank venting and design calculations shall be verified for any modification in the PVRV arrangement of storage tanks. The design shall also incorporate provisions for a silica gel trap and a flame arrestor for ethanol tanks while determining vent size adequacy.
- All the operations shall be carried out as per SOPs.
- Product storage tanks and thermal expansion pipelines shall be inspected and maintained.
- The flameproof enclosures shall be inspected for FLP integrity and that records are maintained.
- ROSOV cables leading to the control room shall be fire resistant.
- The tanks earthing shall be provided through grounding lugs and grounding lug material shall be austenitic stainless steel when attached to carbon or low alloy steel parts.

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Provided for information purposes only. This information should be evaluated to determine if it is applicable in your operations, to avoid recurrence of such incidents.