CASE STUDY

OISD/CS/2025-26/MOPOL/01 **Date: 02/04/2025**

(A) INTRODUCTION

Title : **HSD overflow from underground tank**

Location: **POL Depot**

Loss/ Outcome: **The overflown HSD reached the internal stormwater drain and the municipal drain outside the depot premises.**

(B) DETAILS OF INCIDENT:

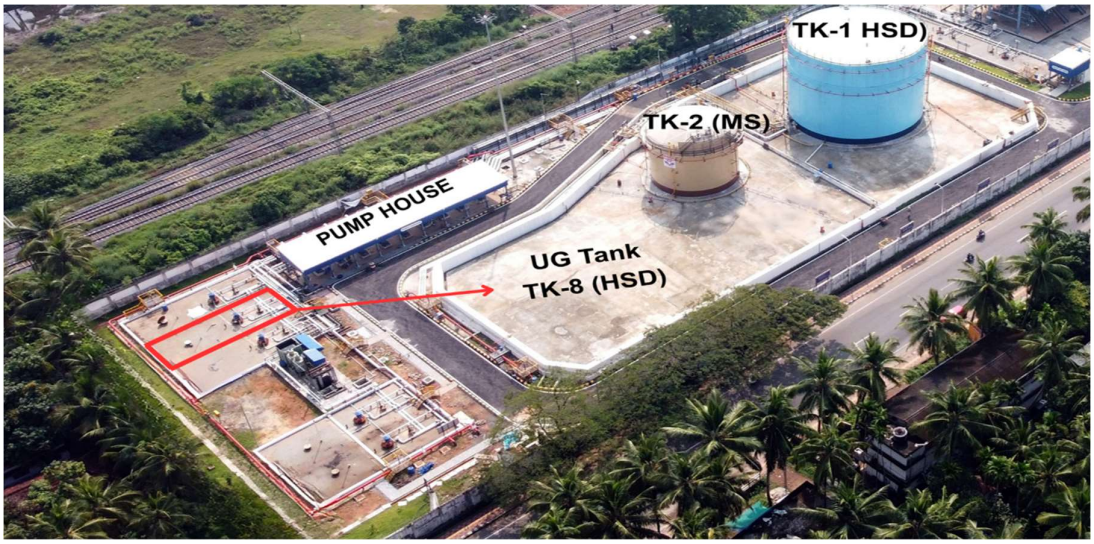
The location has 2 nos. HSD tanks i.e. one underground tank of 180 Kl (say-TK01) and one HSD tank of 4800 KL (Say- TK08). Location receives HSD product from tank wagons only. On the date of incident i.e. 04.12.2024, a wagon rake consisting of 9 MS TWs and 16 HSD TWs was placed for unloading.

After completion of rake receipt, AG tank TK01 was operated for tank truck loading at approx. 1245 hrs. by switching it to “Dispatch TTL” mode i.e. TT loading mode. Approx. after one hour, underground tank no. 8 was lined up for receipt of product through inter tank transfer from TK01 in “Receipt TTL” mode i.e. TT receipt mode. One manual hand operated valve was opened on the TK01 delivery line to facilitate simultaneous TT loading at TLFG and transfer of product to underground tank TK08.

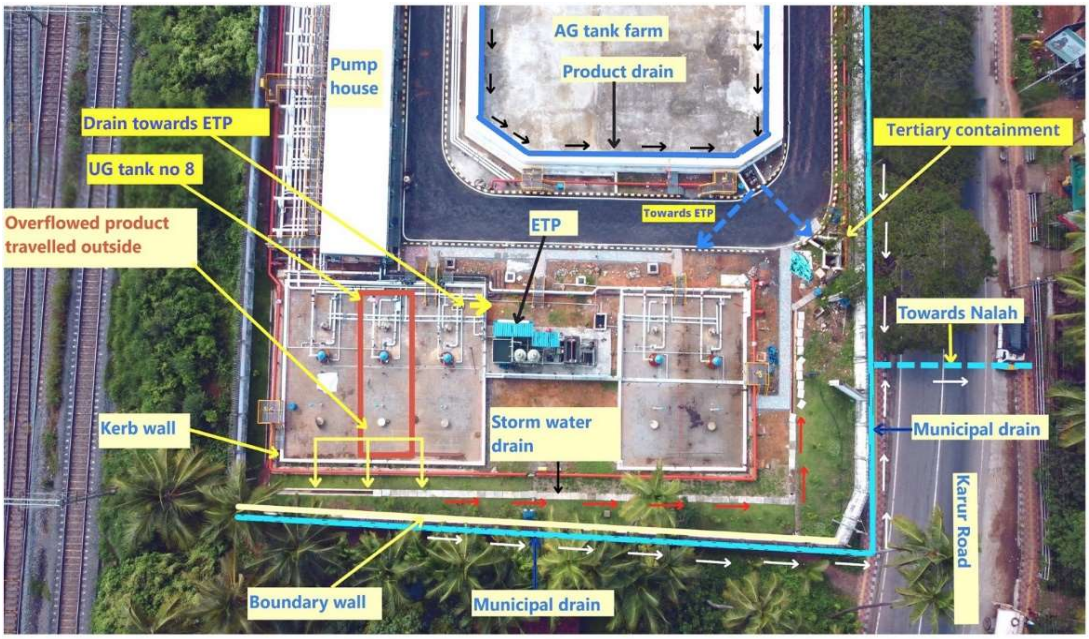
During the transfer of product, UG tank No. 8 overflowed at 1515 hrs. The overflow continued for 13 minutes i.e. till 15:28 hrs. According to the depot officials, the inter tank transfer from above ground tank to underground tank was being done for testing of HHH alarms of UG tanks physically, and the overflow occurred during this activity.

The underground tank farm was enclosed by a kerb wall and the kerb wall had holes. The overflowed product drained through holes in the kerb wall and reached to the internal storm water drain near UG tanks kerb wall and the municipal drain outside the location adjacent to the boundary wall. The distance between UG tank farm kerb wall to the boundary wall towards north was 4.7 meters.

At 1502 hrs, High Level alarm in TK08 generated at its defined level which was 318.0. At the same time, High level alarm was acknowledged. However, details of the person acknowledged the alarm was not traceable in automation system.



(*Bird's- eye view of location)*



(Facilities at location)

(C) <u>OBSERVATIONS & LAPSES</u>:

Location was carrying out two operations simultaneously i.e. tank truck loading and product transfer to UG tank from the same tank (i.e. AG tank no TK01). The SOPs, P&ID and FDS of location was reviewed and observations area as under:

I. As per the SOP for HSD product transfer from the above-ground tank to the underground tank, the manually operated valve at the suction of the product pump was required to be kept closed. Hence, tank truck loading was not permitted while the product transfer was taking place. However, before inter-tank transfer, this valve was not closed, and tank truck loading was allowed simultaneously with the product transfer. This is a violation of SOP for transferring the product from above ground to underground storage tank.

II. As per SOP for product transfer from above ground to underground tanks, the levels of the tank to be monitored continuously from the control room and once the operation is complete, all the valves to be closed. However, continuous monitoring of the levels from control room was not done. During the incident, the control room was not manned by location officials. This is a violation of SOP for product transfer from above ground tank to underground tank

III. As reported by location, the incident occurred during testing of HHH alarm of UG tank no TK8 by physically transferring the product to the underground tank. As per SOP of control room operations and FDS of location, the HHH alarm conditions on above ground tanks shall be simulated through proof test command. Therefore, testing the HHH alarms of UG tanks by physically transferring the product instead of using proof testing via simulation is a violation of both i.e. SOP and the Functional Design Specification (FDS).

(a) <u>Violation of Internal guidelines/ circulars:</u>

As per company internal circular and guidelines, operation in any tank above-ground or underground, shall be carried out only after putting the tanks in appropriate tank mode. It was observed that the correct modes for product transfer, i.e., 'inter-tank dispatch mode' for TK01 and 'inter-tank receipt mode' for TK08, were not selected during the ITT operation of TK1 & TK8. Instead, TK1 was set to 'tank truck dispatch' mode, and TK8 was set to 'tank truck receipt' mode. This is a violation of the internal circular guidelines.

(b) **<u>Deviation from Functional Design Specification (FDS):</u>**

I. As per the FDS, the hand-operated valves installed at the pump house suction header and at the delivery line of the aboveground tank were to be equipped with position sensors to monitor the status of these valves in the terminal automation system. However, the position sensors on the hand-operated valves were not actually provided.

Had the position sensors been installed on the HOVs provided at the delivery line of the aboveground tank (TK01), the status of position sensors in automation system would have prevented the AG tank and UG to be put in TT dispatch and TT receipt mode respectively.

The terminal automation system's equipment/functionality not aligning with the FDS constituted a violation of the FDS.

II. From the TAS alarm logs, the identity of the user who acknowledged the H alarm generated at approx. 1503 hrs was not available in the system. It was noted that the alarm set time, and the alarm acknowledged time was exactly same. Due to some system settings or system malfunctioning, all such alarms were being acknowledged automatically by the system, rather than by the user. The alarms were not being acknowledged by the user, this is a violation of alarm and event management of Functional Design Specifications.

(c) **<u>Servo Gauge on UG Tanks:</u>**

I. All the underground tanks have been provided with a Honeywell Enraf Servo Gauge (Model: 954 Smart Servo Flexline HP). This gauge measures both dip level and product density.

Location sought the Technical Clarification on Servo Functionality from OEM i.e. M/s Honeywell Automation India Limited. The working philosophy of Servo Gauge explained by the OEM is as under:

“When the Servo Gauge is measuring the product level, the displacer always rests on the product surface to follow the product level. When the servo-density command is activated (i.e. the gauge is activated for density scanning mode and paused the Product Level

Measuring mode) then the displacer starts to move downward to complete the tank profile density scan and returned to the product surface after completion of density scan to activate automatically the product Level measurement mode. The servo gauge may take between 20 and 60 minutes to calculate the density measurement in one cycle, depending on the product depth, tank height, and the configured number of density points for the tank profile density scan at the time of the density activation command. During the servo-density scanning period, the TFMS software holds the last valid product level value as stored value." (Working philosophy of Servo Gauge provided by OEM is enclosed as "Annexure-VII") Location officials were aware of this functionality.

The possible causes of HSD overflow from underground tank during product transfer from above ground to underground tank are as follows:

Case I :

As informed by the location, they had scheduled the density measurement time at 1500 hrs for all UG tanks. During the period between 15:03:12 hrs and 15:33:34 hrs, the displace would have moved downward to scan the density and thus would not have updated the levels.
This likely led to the latching of the dip level at 322.1 CMs in UG Tank TK8 between 15:03:12 and 15:33:34 hrs, preventing the HH and HHH alarms from triggering, which would have resulted in an overflow and spillage of HSD.

Case II:

According to the reply submitted by OMC in response to the questions raised in Parliament, the product overflow from the dip hatch of underground tank happened due to malfunctioning of servo gauge and in turn over fill protection system.

II. Independent level Switch:

No hard-wired independent level switch was available on UG tanks. Only one servo gauge was available on the tank.

(d) CCTV Monitoring:

I. The location has installed CCTV monitoring systems at three places: the control room, security cabin, and the location in-charge's room. However, the CCTV was not being monitored at any of these locations, and the overflow incident continued to happen for approx. 13 minutes, and nobody noticed the incident through CCTV system.

II. The overflow incident was captured by the CCTV camera 'Near UG Tank Roadside Perimeter.' However, the view of the CCTV camera was obstructed by a tree inside the location, and the intended area, i.e., the perimeter, was not effectively visible. The tertiary containment valve facility was covered by the 'Transformer Yard Perimeter Camera,' but the view from this camera was also obstructed by tree branches. A CCTV (PTZ) camera installed to cover the HSD TK-08 dyke area had been out of service since April 2024.

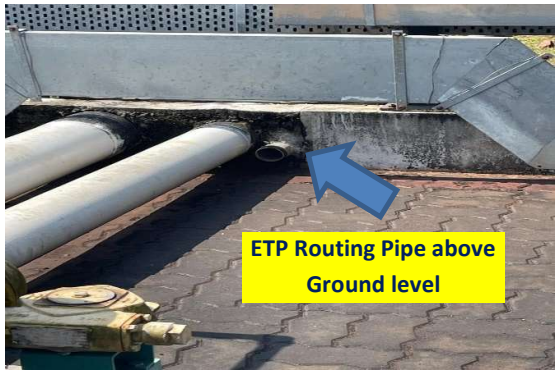
III. CCTV monitoring was provided in the control room, but it was positioned opposite the TAS display screens, at the back side of the Control room In-charge seating position. This setup makes it difficult to monitor the CCTV system, as it can only be accessed intentionally. The display was not positioned at location where the continuous monitoring can be done.

(e) Drainage system:

I. The kerb wall of the UG tank farm had three holes towards storm water drain. It was observed that the overflowed product seeped out of the kerb wall thru the holes. Location officials didn't notice the same during daily safety inspections and didn't record the same under unsafe conditions.

II. On the north side, the basement of the boundary wall was constructed with random rubble masonry. The overflowed product would have percolated through the loose sand, crossing the boundary wall via the RR masonry foundation, and reached the outside drain running parallel to the boundary wall. Oil-soaked soil was observed between the kerb wall and the boundary wall.

III. The drain in the UG tank kerb wall area was provided. However, the slope of UG tank farm was towards north side whereas the existing drain was provided at southwest side and was directed towards ETP. The inlet of the drainpipe was approx. 80 mm above the dyke floor. The provided drainage was not effective, and this deviation was not recorded by location during routine inspection and maintenance and during the internal audits.



IV. There was a stormwater drain within the location that leads outside through the tertiary containment valves. A sluice gate was not provided in the stormwater drain at the tertiary containment, only gate valves inside the pit were installed. The storm water drain was connected to the outside drain through these gate valves. During investigation, it was observed that one of the gate valves was leaking even when in the closed position. Non availability of sluice gate on tertiary containment is a violation of cl. 6.4.2 (f) of OISD-STD-244.

(f) Safety Audits:

Last multi-disciplinary safety audit (ISA) of the location was carried out in March'24. There was total 32 nos. recommendations. Upon reviewing the last MDSA report, no recommendations were found regarding the holes in the underground (UG) tank kerb walls and the drainage of the underground tank farm area.

Due to limited storage capacity, no ESA of the depot was conducted by OISD.

(D) RECOMMENDATIONS:

Following corrective actions are recommended to avoid recurrence of such incidents:

(a) Strict Adherence to SOPs, internal guidelines/ circulars and FDS:

- Approved Standard Operating Procedures (SOPs) shall be strictly adhered to for all operations. The location shall ensure the operation of hand-operated valves in accordance with the valve sequence specified in the SOP for all operations.
- As outlined in the SOP, the levels of the tanks shall be continuously monitored from the control room during the transfer of product from the A/G tank to the U/G tank. All operations shall be carried out under the supervision of a responsible officer (Refer to Clause 8.2 (vi) of OISD-STD-244).
- HHH alarm testing and interlock checking shall be performed using the proof test method, as per the approved SOP & FDS.
- Location shall ensure that operation in any tank, A/G or U/G, shall be carried out only after putting the tanks in appropriate tank mode. The location shall ensure compliance with the approved SOPs, company internal circulars/ guidelines, and OISD standards for safe operation.
- The location shall ensure that the FDS is followed in TOTO. It shall be ensured that all physically available equipment and facilities are provided in accordance with the functionality and operational requirements specified in the Functional Design Specifications (FDS).
- The reason for system malfunctioning related to auto acknowledgment of alarms shall be analysed. It shall be ensured that the logs for all alarms include all requisite details, such as time, date, and user ID of the person acknowledging the alarm, along with the correct date and time.

(b) Servo Gauge on UG tank:

- The location shall review the functioning of all level transmitters and ensure that the levels in the product tanks are monitored and recorded continuously on a real-time basis. The location should not use of such level transmitters that do not measure product levels during the density scanning period.
- In case of space constraint on UG tanks, the location shall provide at least one level transmitter radar type (for low/ high level alarm) and one additional level switch/ level transmitter for suitable interlock.

(c) **CCTV Monitoring:**

- Location should use of mounted CCTV cameras at installation for monitoring of unsafe acts and unsafe condition. (Refer cl. 7.6.8 (d) of OISD-GDN-206.
- It shall be ensured that there are no obstructions in the view of CCTV cameras. Periodic maintenance should be carried out to ensure that the areas covered by the CCTV cameras are clearly visible. CCTV shall be installed in depot / terminal covering all critical operating areas (Refer cl. 6.4.5 (e) of OISD-STD-244)
- CCTV display shall be repositioned to a more visible and accessible location in the control room, allowing for continuous monitoring. The display should be positioned where operators can easily view it while performing other tasks.

(d) **Drainage system:**

- The location shall strengthen the inspection and maintenance of the underground tanks (UG) kerb wall area. The kerb walls around UG tanks shall be inspected to ensure there are no holes. Drains shall be provided in the UG tank kerb wall area so that in case of any spillage, the overspilled product is directed to the ETP/OWS.
- Depot shall be provided with boundary wall with gates and sluice gates on drain to meet the objective of tertiary containment in accordance with cl. 6.4.2 (f) of OISD-STD-244). Inspection and maintenance of the drain valves shall be strengthened.

(e) **Culture of reporting unsafe acts and unsafe conditions:**

The location shall promote a culture of reporting unsafe acts and conditions at all levels. All unsafe acts and conditions shall be recorded, and compliance of the identified deviations/ gaps shall be ensured in a time bound manner.

(f) **Safety audits:**

OMC shall review and strengthen the effectiveness of its internal safety audit processes. Due diligence shall be exercised in recording all observations, identifying potential risks, and addressing any deviations or safety concerns.

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