CASE STUDY

OISD/CS/2020-21/P&E/02… Date: 28/05/2020

INTRODUCTION

Title: **Fire incident on Maintenance Vessel used for SPM maintenance.**

Location: **During MBC replacement job carried out on the Maintenance Vessel.**

Loss/ Outcome: **Fire took place on Maintenance Vessel and the incident resulted in four fatalities.**

BRIEF OF INCIDENT

A fire incident had occurred on Maintenance Vessel. The fire took place during replacement of leaking Marine Breakaway Coupling (MBC) which parted during the end of cargo discharge operation of crude oil tanker through Single Point Mooring (SPM). The incident resulted in fatalities of four contract workers and severe burn injuries to eight other workers.

OBSERVATIONS

- A Tanker was discharging crude oil through SPM system into shore tanks. Final stripping operation was going on and one hour notice for completion of cargo discharge was given. At this time, a rain squall approached the SPM location. From the telemetry data, it was noted that wind speed increased from around 6 knots (approx.) to 35 knots (approx.) within short time. Wind direction also changed about 40^0 and danger warning indicated tanker to buoy closest distance as 20 M during this period.
- With the extra pull from the pullback tug and the wind at the location, Tanker started drifting away from the SPM. Suddenly, both the mooring hawsers snapped. The maximum load recorded on DCS of load cell in port side hawser was 114.3 T which then came down to zero. This suggests the time of parting of hawsers. Then floating hoses also got parted after MBCs got activated in both the strings. Tanker drifted away from the SPM. Pumping was still going on based on the trend records available in DCS. Tanker engine was started only after parting of hawsers and hoses. Once the SPM area was clear, support craft were able to inspect the area. It was reported that there was no major oil spill.
- During first daylight hours next day, leak was noticed from actuated MBC portion of parted inner string attached to the buoy. Extent of leakage could not be ascertained as string end was submerged in the water due to weight of parted MBC. On being informed, Port Control instructed owner to contain the oil spill immediately. The Maintenance Vessel - B available at the site had the Oil Spill containment booms and recovery system on board and the same was deployed to contain the oil spill. The other two small supporting boats were also involved in the oil spill containment activity.
- Early in the morning, Coast Guard informed that the spill was increasing and if no immediate action was taken to arrest the leak, the spill could travel to close by beaches and would become a grave disaster with severe environmental repercussions. The situation therefore called for immediate stoppage of the leakage and containment of the oil spill.
- As the alternate Maintenance Vessel - B & support boats available at the site were involved in the oil spill containment activity, the O&M contractor (hired by owner) decided to mobilise main

Maintenance Vessel – A for lifting the parted hose attached to SPM. This main Maintenance Vessel - A had just completed an extensive dry docking (underwater inspection) and was undocked recently and was alongside the fishing harbor for completion and balance certification (including inspection of above water portions). It may be noted that this main Maintenance Vessel - A was the only vessel which was having A-frame which is essentially required to lift the hose and remove the leaking MBC. This main Maintenance Vessel - A was used previously also to carry out the MBC replacement in the past (seven years ago) when the MBC got parted and arrested the leakage successfully.

- The pickup rope was connected to the inner end of the hose and hose was lifted on to deck. Portion of hose near A-frame was kept at an elevation to minimize the spillage. It was observed that one petal on the MBC was not holding and the leakage was larger than anticipated. O&M contractor decided to immediately disconnect the MBC and insert a blind flange with a gasket to permanently shut off the leaking hose. After disconnection of the actuated MBC, maintenance team was in the process of inserting the blind flange at the end. The leakage was being collected into a tank on the port side of the deck. Precautions to contain the oil spillage on main deck were taken by providing absorbent booms but oil spilled through this due to sea roughness and swell. O&M contractor personnel who were working on board felt uneasiness due to excessive vaporization of crude.
- Suddenly, an explosion was heard and a fire broke out resulting in extremely intense heat and thick, acrid smoke on the deck of main Maintenance Vessel - A. Immediately all personnel on board this vessel jumped into the water. Alternate Maintenance Vessel - B, support boats and Coast Guard vessel which were at the location immediately rescued personnel from the water. Firefighting actions by Coast Guard and port tugs were commenced immediately. All the casualties were immediately shifted to the jetty and sent to the hospital by the ambulances waiting at the location.
- Firefighting continued for 4-5 hours. In between, after 2-3 hours, O&M contractor personnel entered the main Maintenance Vessel – A, which was on fire and activated the CO_2 suppression system. This helped in extinguishing the fire. Out of the four fatalities, two were dead at site on the day of incident and two later succumbed to burn injuries at Hospital.
- Later on, the main Maintenance Vessel - A was physically inspected. It was ascertained that the entire engine room seemed to have been engulfed in fire. Main area of the flame appeared to be the starboard side near the emergency exit of the engine room. The electrical panels of the main engine and one of the MSB on the starboard side near the emergency exit were fully burnt and deformed. Some amount of fire melt areas were also seen on the starboard side including some parts of the starboard Main Engine.
- The fire appeared to have started from an ignition point in the engine room near the MSB panel or from generator which was in operation at that time. The most probable reason for explosion appears to be presence of highly flammable gases in the engine room due to which fire spread quickly to the entire oil spill (including vapor) on the main deck.

REASONS OF FAILURE/ ROOT CAUSE

- In telemetry system, there were large number of alarms registered for operation during cargo discharge:
  - on combined hawser load danger/ warning/ starboard hawser load warning.
  - on “distance between tanker and buoy as low” when tanker was berthed at SPM.
  - about tanker on red/ orange sector.

  The main reason for such huge number of alarms was due to load pin instrument failure in starboard side and ineffective Bow monitoring and pull back operation. This was a serious issue as control room operator was not able to monitor the system properly.
- Inner string MBC did not perform the way it should have performed in ideal condition. It leaked on activation. This created panic situation and urgency to arrest the leakage. MBC, which was due for refurbishment a year back, was not replaced.

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- Deployment of alternate Maintenance Vessel - B in place of main Maintenance Vessel - A which was not having the same facilities e.g. A-frame and enough deck space for carrying out such maintenance. Due to this, there was no choice left for carrying out the removal of leaking MBC other than through main Maintenance Vessel - A (which was still under dry dock activities).
- Main Maintenance Vessel - A was taken to SPM without having valid certificate/ clearances for sailing. As per Port Trust report, hot work was pending and vessel had gaps on the deck. Through these gaps, crude oil seeped into the engine room and caught fire. Although, O&M contractor has taken the vessel in the larger interest of mitigating environmental disaster but had not anticipated the rough weather resulting in overspill of crude oil from floating hoses onto deck of main Maintenance Vessel - A.
- As observed during OISD External Safety Audit, Weather prediction were not being arranged by the owner. This would have facilitated early warning to the Pilot and the Boarding Officer to take preventive measures.
- SOP for tanker operation in bad weather was not available. Bow watch and pull back operations were not well coordinated and effective. This led to hawser failure and subsequently MBC activation.
- Job Safety Analysis (JSA) was not carried out before taking up the non-routine activity like removal of actuated MBC. Learning from similar incident happened in past has not been documented and implemented while attending hose maintenance when it is filled with oil on activation of MBC.
- Many of the trends and details from the system were not downloaded prior to the time of enquiry (after 4 months). Owner personnel's awareness on SPM DCS panel seems inadequate.
- Even though such a fatal incident had occurred, internal enquiry report of owner is not covering the basic principles of enquiry investigation like lapses observed, root causes of failure, recommendations to avoid such incidents in future.
- Owner has adopted a modified spool system for MBC replacement. However, post incident, there is no communication from owner side to O&M contractor highlighting the root cause analysis of the incident and suggesting corrective actions to avoid such incidences in future.
- There is no system of internal audit through multi-disciplinary team for the SPM operations/ maintenance in place. Near miss incident reporting system in case of SPM operations/ maintenance works is not there. Internal audit mechanism and near miss reporting system brings about gaps in the system to take corrective action.
- Risk analysis on direction of oil movement and its impact on environment had not been carried out. Sufficient resource persons, for estimating the quantity of oil in such cases that is exposed to risk of oil spillage, are not available either with O&M contractor or owner.
- There appeared to be over reliance on offshore O&M contractor for day to day activities at the SPM location and hardly any review of their work was being done from owner end.

RECOMMENDATIONS

- Telemetry system and DCS should be made functional in all respects without false alarms by replacement of faulty sensors (e.g. load cells). Panel operators need to be trained to respond promptly on alarms.
- Operator personnel's awareness on SPM DCS panel needs to be enhanced through periodic training.
- Weather prediction is to be arranged by owner.
- Bow watch and pull back operation to be made more coordinated and effective. SOP for the same to be made for possible scenarios (e.g. bad weather) and all the concerned personnel to be adequately made aware through written instructions and wherever possible through effective training.

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- Remaining life assessment of failed hawser to be carried out. Whenever hawser is retired, remaining life assessment shall be carried out and shall be recorded for future reference.
- MBC to be refurbished within time period as per OEM recommendations.
- A modified spool system (in consultation with OEM) to be put in place for safe replacement of activated MBC at all locations.
- SOP to be developed for replacement of activated MBC.
- Job Safety Analysis (JSA) to be carried out before taking up the critical activity like MBC replacement job.
- Whenever, Maintenance Vessel is taken for periodic survey/ dry dock, it shall be ensured that alternate vessel being deployed is having same facilities (e.g. A-frame, enough deck space) for maintenance activities.
- Maintenance Vessels with statutory certificates/ clearances shall only be deployed for SPM related activities.
- In line with rule-25 of Petroleum and Natural Gas (Safety in Offshore Operations) Rules, 2008, detailed Risk Analysis on direction of oil movement and its impact on environment are to be carried out. Availability of sufficient resource persons either with O&M contractor or owner for estimating the quantity of oil in such cases that is exposed to risk of oil spillage is to be ensured.
- In-house competency for SPM related operations/ maintenance activities is to be enhanced through training for better coordination and supervision with O&M contractor.
- A system for incident investigation by a multi-disciplinary team from another location to be put in place to find the root causes and the same is to be widely shared.
- A system of internal audit for the SPM operations/ maintenance activities through a multi-disciplinary team is to be put in place on yearly basis.
- Near miss incident reporting system in case of SPM operations/ maintenance jobs is to be put in place.



Maintenance Vessel on fire

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