South African Maritime Safety Authority

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Lessons Learned from a recent fuel oil spill in port

TO SHIP OPERATORS, MASTERS, SHIPS AGENTS, REGIONAL MANAGERS AND PRINCIPAL OFFICERS

Summary

SAMSA has recognized the need to publish the lessons learned from a recent oil spillage during bunkering operations in port. A total of 15 procedural and physical barriers had been broken, resulting in approximately 5 to 8 m3 of Intermediate fuel oil in the water.

Introduction

A non-convention vessel was berthed at Duncan Dock, Cape Town Harbour and prepared for bunker operations. A pre-bunkering meeting had been held, but not all personnel involved with the bunkering operation were present (such as the OOW and gangway watch). The intention was to load 1000 m^3 of Intermediate fuel oil (IFO) to various tanks, including tanks known to give erroneous soundings when freezers in the fish holds were active.

An oil spill was reported after oil was seen flowing over the Port side of the vessel at the gangway. The gangway watchman had been away from his post, which was near the vent-pipes of the tank that overflowed and could therefore not report the overflow onto deck when it occurred. The considerable space on deck was taken up by the fuel oil, and eventually flowed over the fishplate and down the side of the vessel.

There was no shore watchman at the shore manifold as per the pre-bunker checklist requirements. It was a cold rainy mid-winters night, and both the bunker company watchmen were in the company truck which was parked some distance from the manifold area. There was no emergency stop at the gangway watchman's post (as is industry best practice), and he was thus unable to shut the pump down immediately in any case.

The vessel crew attempted to contain the spill as best they could, and informed Port control and SAMSA shortly after. The wind was blowing onto the quay-side and the large spill could be seen extending well beyond the vessel. It is an estimated that the oil slick extended approximately 450m, although it was difficult to determine at night.

Once the SAMSA duty surveyor was in attendance, a prohibition on further bunkering operations was placed on the vessel. The vessel's Local General Safety Certificate, Safe Manning Document, IOPP certificate, and Oil Record Book were placed in custody by SAMSA until the investigation could be completed. Following the timeline of events already mentioned above, it was estimated that a quantity of between 5 and 8 m^3 of IFO had been spilled into the harbour.

Analysis

There were several direct and indirect causes contributing to this event. There were also several barriers specifically designed to prevent pollution that broke down, due largely human elements.

1. Quality of fuel control

Due to the quality of fuel bunkered at a previous port not being vetted properly, a much higher pour point (of around +3° C) was inherent in the fuel. Previous fuels bunkered had lower pour points (in the region of -10°

C). Thus, the cold storage adjacent to the sounding pipes caused the fuel to coagulate. This had 2 effects on the operation. Firstly, when the fuel pump lost suction on the specific tank (that overflowed) during the voyage, it was incorrectly assumed to be empty by the engineering staff. Therefore, when personnel sounded the tank prior to bunkering, they were expecting an empty tank. Secondly, the soundings would be confounded by the coagulation of the fuel, and accurate readings would be very difficult in such conditions. The breakdown of the barrier lies in the fact that it was known that these 3 fuel tanks are prone to erroneous readings when the cold storage is active, and this was not considered. This barrier is procedural in that these tanks were known as being "not supposed to be used" when bunkering from outside onto the vessel. The breakdown thus constitutes a procedure not followed. The procedure governing the vetting of fuel specifications is considered another barrier, but can also be considered defective or weak because they had not prevented the use of inadequate fuel.

2. Tank gauging system

The tank gauging system usually forms an integral barrier against overflowing because the watch-keeper has access to dynamic changes in the volumes for tanks. The tank gauging system on the vessel has been defunct for at least 2 years. A quotation was done for replacing/repairing the system, but was never followed through. This constitutes the break-down of the barrier due to lack of risk awareness by the management of the vessel.

3. Tank soundings

Tank soundings were taken by the crew every 30 minutes. The sounding taken at 19h30 was 0.44 for the tank that overflowed and was noted as 20 m³. By using the capacity tables in the SAMSA Approved Stability booklet, interpolation leads one to find (0.4m = 13.495 m³; 0.5 = 18.569 m³) that the loaded capacity for the tank was expected to be in the region of 15.5 m³, with the vessel on an even keel. This constitutes a differential of almost 25%. It was stated by the Chief Engineer that watch-keepers were using the flow meter as opposed to actual soundings. However, evidence aboard suggests that the watch-keepers were also using very old Russian graphs as opposed to the tables supplied in the SAMSA approved stability booklet from 2017. In either case, the inaccuracy is compounded by the difficulties described in point 1 above, i.e. the coagulation of the fuel and the proximity of the cold storage.

The heating coils in the tanks are also not functional and have not been used. This could also have prevented the coagulation of the fuel. The barrier was further weakened by the fact that the sounding pipe was modified somewhere in the past and the new distance from the sounding pipe top, to the striker plate, is not known to watch-keepers. Access to the sounding pipe cap is now 2 decks below the uppermost continuous deck whereas it used to be up on maindeck.

(Sounding pipes, filling lines, etc. leading to tanks containing hydrocarbons should have self-closing devices of some kind with a pressure relief of some kind as per industry best-practice. The self-closing can be spring-loaded or weighted, but the point is that if a watch-keeper has done a sounding the pipe should not be able to be left open to prevent flooding of the space)

The breakdown of the barrier can be attributed to poor procedure/lack of procedure, and because the watch-keeper did not recognize the risk in not knowing where the striker plate was, lack of risk awareness/lack of training.

4. Bunker procedure

The bunkering procedure for a vessel is the main barrier against spills. The procedure provides guidance to all personnel involved with these operations, and is a fundamental part of a vessel Approved SOPEP Manual. It also provides a framework of items for discussion at the pre-bunker meeting, to ensure that personnel are fully aware of their responsibilities and duties. As stated above, there were several instances where items on the bunkering procedure and checklist had not been adhered to.

4.1 Maximum loading rate. The agreed rate had been 80 m³/h. This meant that the rate when the spill occurred was 50% in excess of the agreed rate (120 m³ as recorded in the Bunker suppliers shore tank farm logs). There was no record presented of who made the decision to change the agreed rate, or why and when the decision was made. The flow rate is usually a free-standing barrier on its own, but in this

case it compounded the situation. With no manifold watch or gangway watch present, there was a lot less time to respond to the overflow onto deck because the flowrate had increased to a much higher volume per hour than that agreed at the opening meeting. This constitutes the breakdown of this barrier due to not following procedure.

4.2. The need for a reduced loading rate when changing over tanks. The procedure calls for lowering the rate or having multiple tanks open. This constitutes the breakdown of this barrier due to not following procedure.

4.3. All personnel involved should attend the meeting to discuss the operation. The Deck OOW and gangway watchman were not present for the meeting and were thus unaware of the specifics discussed during the meeting. This constitutes the breakdown of this barrier due to not following procedure.

4.4. Ensuring that the bunker connections are properly supervised. By all reports there was no regular deck patrols focusing on the following locations: the bunker manifold, the fuel vent of tanks being bunkered, the gangway, and nobody ashore at the emergency stop station. This constitutes the breakdown of this barrier due to not following procedure.

4.5. All fuel tanks sounded prior to commencement of bunkering. It is not clear whether soundings were done prior to commencement. It was stated that the tank was assumed empty due to having lost suction during the trip. In any event, the soundings were not accurate and some of the tanks were not entirely empty. This constitutes the breakdown of this barrier due to not following procedure/lack of risk awareness.

4.6. Checklist for overflow tank to be completed and signed off (by Chief Engineer and the Duty Engineer Officer of the Watch.). The checklist had been completed, confirming that both Chief Engineer and Duty Engineer Officer of the Watch had done physical checks before signing. This constitutes the breakdown of this barrier due to not following procedure.

4.7. The overflow tank sounded & confirmed to be empty. It is not clear whether this was done, but the checklist had been completed, confirming that both Chief Engineer and the Duty Engineer Officer of the Watch had done physical checks before signing. This constitutes the breakdown of this barrier due to not following procedure.

4.8. The overflow valve to be manually checked by the Chief Engineer and 3rd Engineer. The overflow valve was later found to be fully or partially closed. The checklist had been completed, confirming that both Chief Engineer and the Duty Engineer Officer of the Watch had done physical checks before signing. This constitutes the breakdown of this barrier due to not following procedure.

4.9. The overflow alarm and overflow high level alarm to be tested and signed off as working (by Chief Engineer and the Duty Engineer Officer of the Watch.). The overflow alarm did not function during the spill. The checklist had been completed, confirming that both Chief Engineer and Duty Engineer of the Watch had done physical checks before signing. This constitutes the breakdown of this barrier due to not following procedure.

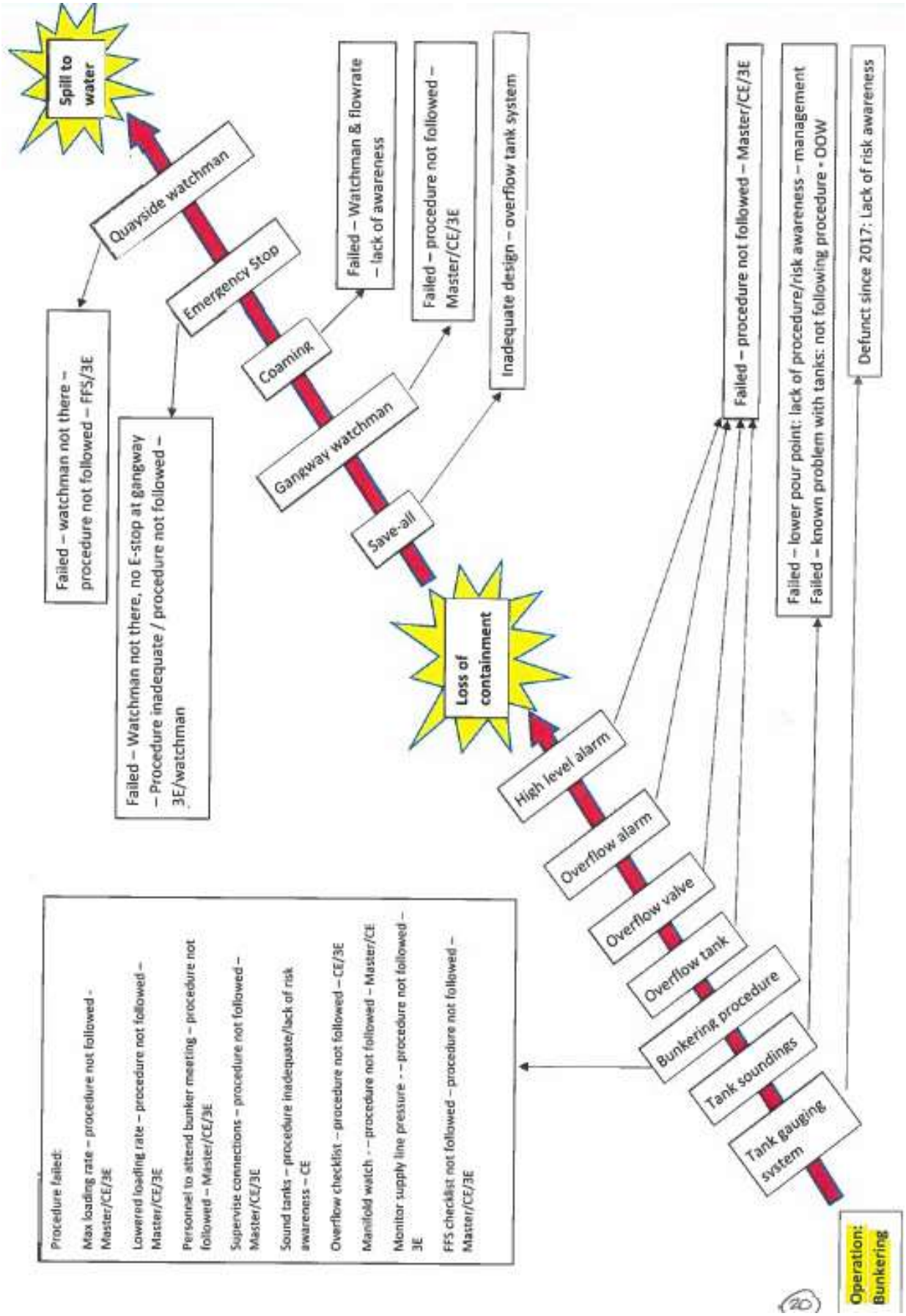
4.10. Maintain a manifold watch. By all reports there was no deck patrol at the manifold, the fuel tank vents of tanks being bunkered, the gangway and nobody ashore at the emergency stop station. This constitutes the breakdown of this barrier due to not following procedure.

4.11. Monitor the supply line pressure. It is not clear when this pressure gauge had been calibrated, but it is safe to say that a spike in pressure would have preceded the overflow of fuel from the vent pipe. This was not recognised by the watch-keeper and indicates a lack of risk awareness.

4.12. The bunker company checklist had items marked with "R" which constituted critical items which were to be rechecked hourly. The items identified on the signed bunker checklist provided by the bunker company had not been checked once in the 6 hours preceding the oil spill. This constitutes the breakdown of this barrier due to not following procedure.

Due to the spill incident the vessel was subjected to a SAMSA Ad-Hoc Audit for a vessel of its size, and various MARPOL infringements were noted. This resulted further action being taken by the SAMSA office involved in this incident.

Bowtie analysis of the barriers that broke down:



Conclusion:

Further to the investigation into the incident, it came to light that there have been previous incidents with bunkering on this vessel. Another bunkering company had filed several incident reports after working with this vessel. There have been several repeat findings from the incidents that have to be taken into consideration in this instance:

1. Failure to follow procedure.
2. Failure to maintain a proper watch on bunkering operation.
3. Failure to line up valves properly.
4. Failure to sound tanks accurately.

Given that there are several repeat findings (8), the conclusion can be drawn that whatever measures were put into place following previous spills from this vessel have not been effective at curbing the tendency to spill oil. The most worrying is the lack of following procedure because the risk associated with it cannot be engineered out of the equation.

A vessel of this size would usually be subject to the ISM (International Safety Management) convention if it was a convention vessel, but because it is a fishing vessel, ISM does not apply. Management of the vessel would do well to institute and train their personnel in the use of a robust safety management system. It is rare to see this many barriers fail in any operation, and yet it seems to happen at regular intervals on this vessel.

Recommendations:

1. Management teams of these type of vessels should produce a vetting process for fuel before loading.
2. Tank gauging systems on these vessels should always be functional.
3. Heating coils should be functional; or alternately such tanks should be excluded from the external bunkering procedure.
4. Sounding pipes for tanks carrying hydrocarbons that end below the watertight deck must be fitted with a self-closing device(s). Viz. regulation 38. Sounding pipes in construction regulations.
5. Sounding pipes for modified tanks must be measured - by a naval architect or similar - and the distance to the tank top known to watchkeepers.
6. Isolation processes for the high-level alarms should governed by robust procedures, published and signed by watch-keepers.
7. Emergency stops should be instituted at the manifold and watchman positions for all vessels.
8. Management teams of such vessels should adopt a QMS and process-based thinking – including training for all personnel.

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