Isle of Man

Marine Administration

Casualty Investigation Report No. CA 82

“HAPPY FALCON”

Accident during gas freeing operations of No.1 Cargo Tank

on 10th January 2003

Contents.

Summary

"Happy Falcon" is a Type 2G Gas Carrier of 3366 GRT. On the morning of the 10th January 2003 the vessel was alongside undergoing inerting and gas freeing operations by shoreside contractors at Zeebrugge. During the gas freeing operations the Chief Officer slipped and fell into/or entered No.1 Tank and was overcome.

The alarm was raised and the crew attempted to rescue the Chief Officer. An AB donned breathing apparatus and entered the tank to attach a rescue harness and line to the Chief Officer and assisted from below whilst the crew pulled the Chief Officer out. Unfortunately the AB fell back into the tank at the moment the Chief Officer was pulled through the tank opening.

Another rescue was then made by the crew, an OSMN donned breathing apparatus and entered the tank to attach the safety harness and line to the AB and the crew then pulled out the AB. During this rescue the breathing apparatus worn by the AB had become dislodged.

Both men were overcome by the nitrogen vapour in the tank, the Chief Officer receieved injuries to his arm and face and the AB received injuries to his scalp and arm. The AB was also suffering from cardiac arrest and the deck officers administered CPR on the deck. Both men were resuscitated onboard and taken ashore to hospital, the Chief Officer later recovered, however the AB died.

It is concluded that this was an unfortunate accident whereby the Chief Officer slipped and fell into the tank and that the subsequent rescue made by the crew saved this Officer's life. It is also concluded that the AB fell back into the tank at the moment of the Chief Officers rescue and lost his life helping to save the Chief Officer.

Recommendations are made with reference to the need for continual reminders of the dangers involved with inerted tanks and enclosed space entry and the need for tighter controls of the interface between ship and shore personnel when shoreside contractors are used for inerting tanks and gas freeing operations.

It is also noted that regular drills for the rescue of personnel from inerted tanks and enclosed spaces as carried out on this vessel can save lives as shown in this case.

1. Narrative of Events

1. The 'Happy Falcon' is a Type 2G Gas Carrier of 3366 GRT with registered dimensions of 89.37 m x 14.40 m x 6.25 m.

   1.1 The vessel is classed with Germanischer Lloyd and is registered in the Isle of Man (Demised In) with the underlying Register as Panama.

   1.2 The owners are Adella Shipping & Finance, Panama, demise charterer is Ramon Marine (IOM) Ltd, managing owners and technical operators are Hanseatic Shipping Company, Cyprus, and commercial operators are Unigas International B.V..

2. There are two cargo tanks forward, No.1 Cargo Tank of 1864 m3 and No.2 Cargo Tank of 1908 m3. On the previous voyage No.1 Cargo Tank had contained raffinate-1 and No.2 Cargo Tank had contained polymer grade propylene. As the next cargo was a full cargo of chemical grade propylene, No.1 Cargo Tank was the only tank to be purged.

   2.1 Purging of the tank is done to remove the vapour in the tank, normally by heating to liquid free, then inerting the tank with nitrogen to below the lower explosive limit and then gas freeing by air ventilation.

   2.2 Liquid freeing is normally carried out at anchorage prior to proceeding to port for inerting and gas freeing.

   2.3 Once the tank is gas free and the oxygen content has reached 21%, the tank can be entered for inspection to ensure it is suitable for the next cargo.

   2.4 The tank is then re-inerted with nitrogen prior to loading.

   2.5 There is not normally a requirement to purge tanks that will carry the same grade cargo, unless specifically requested by the commercial operator.

   2.6 In this case the nitrogen was to be supplied from shore and the purging operation (inerting, gas freeing and re-inerting) was to be undertaken by shoreside contractors.

3. The vessel berthed at Zeebrugge at 0120 on the 10th January 2003 to carry out purging of No.1 Cargo Tank. All times are local mean time, GMT + 1 hour.

4. Following berthing a meeting between the shore contracted gas surveyor, the Master and the Chief Officer took place to discuss the purging procedure.

4.1. An email was sent to the ship from the commercial operators on the 9th of January 2003 stating the procedures to be used and that No.1 Cargo Tank was the only one to be purged.

4.2. No minutes of the meeting were recorded and there is no evidence to state exactly what was discussed or what the agreed procedures to be used were.

5. At 0145 hours the cargo tanks were checked for gas concentration at the top, middle and bottom prior to commencement of purging of No.1 Cargo Tank.

5.1 Gas concentration readings at 0145 hours were 5.7% Top, 5.2% Middle and 3.7% Bottom.

5.2 At 0205 hours the shore hose connections were made and at 0245 hours purging was started with depressurising the tank with vapour to shore .

5.3 At 0335 hours depressurisation of the tank was completed and Nitrogen was introduced into the tank at 0340 hours.

5.4 Nitrogen from shore was supplied to the top of No.1 Cargo Tank via the vapour line and the gas vapour was expelled from the bottom of the tank via the liquid line to the shore flare.

5.5 Chief Officer left the deck at 0400 hrs and instructed the 2nd Officer to wake him if anything happened.

5.6 2nd Officer went to bed when he was relieved from the watch by the 3rd Officer at 0600 hrs.

5.7 Pressure readings and gas concentrations were taken at 0530 hours, 0700 hours and 0800 hours which showed progressive drops in the readings.

5.8 At 0800 hours the readings taken were a pressure of 0.11 bar gauge and gas concentrations of 0% Top, 2% Middle and 5% Bottom.

5.9 Nitrogen was stopped at 0830 hours and the shore contracted gas surveyor gave permission for No.1 Cargo Tank lid to be opened.

6. The Chief Officer, 3rd Officer and AB opened the tank dome lid to No.1 Cargo Tank in readiness for inserting the shore side ventilation hose.

6.1 At 0845 hours the ventilation hose was inserted through the tank dome opening.

6.2 The Chief Officer was at the dome opening lowering the ventilation hose into the tank.

6.3 The 3rd Officer was pulling the hose from the shore onto the deck on the port side of the vessel.

6.4 The AB was ashore handing the hose onto the vessel.

6.5 The shore contracted gas surveyor was attending the air blower machinery ashore.

7. There is no evidence to state with certainty exactly how the Chief Officer came to be in the tank, the 3rd Officer had his back to the Chief Officer and the AB was on the dockside, both the 3rd Officer and AB were busy handling the air hose onto the ship.

7.1 At 0850 hours the 3rd Officer heard a noise and turned towards the tank dome and noted the Chief Officer had gone. He moved to the dome lid opening and saw the Chief Officer lying on the mid height platform inside the tank.

7.2 The 3rd Officer ran to the accommodation and raised the alarm at 0851 hours. He shouted to those in the mess room and then to the bridge and gave out a PA broadcast.

7.3 The AB returned onboard and prepared to enter No.1 Cargo Tank with a safety line.

7.4 The shore contracted gas surveyor had also come onboard and warned the AB not to enter the tank without a breathing apparatus.

7.5 The ships crew began assembling and the AB donned a breathing apparatus with the help of the 2nd Engineer and entered the tank.

7.6 The shore contracted gas surveyor returned ashore to raise the alarm and called the emergency services.

7.7 At 0855 hours the crew manhandled the Chief Officer onto the deck from the tank dome opening having raised him using the safety line. The 3rd Officer and 2nd Officer administered oxygen to the Chief Officer who was still breathing.

7.8 At the very moment the Chief Officer was pulled from the tank a noise was heard from within the tank and it was noted that the AB had now fallen to the mid height platform inside the tank.

7.9 The Ordinary Seaman / Messman donned a breathing apparatus and entered the tank with the life line.

7.10 The shore contracted gas surveyor had again returned to the ship and on hearing two men were down in No.1 Cargo Tank went ashore to find an experienced first aider in the Euroservices local office.

7.11 At 0900 hours the AB was manhandled out of the tank onto the deck and was found to have no breathing or pulse.

7.12 CPR was administered to the AB by the 2nd Officer and at about 0903 hours the shore side first aider arrived and helped with CPR.

7.13 At 0907 hours an emergency services ambulance arrived and the emergency staff took over the care of the Chief Officer and the AB.

7.14 At 0915 hours additional emergency services arrived at the ship and assisted. The Chief Officer and AB were lifted ashore and taken to the Saint Jan hospital in Brugge at 1000 hours.

8 The Chief Officer partially recovered and was repatriated to the Philippines three weeks later. The AB did not recover consciousness and was declared dead four days later when his life support machine was switched off.

2. Comment and Analysis.

1. Procedures

1.1. The procedures for gas freeing at the berth have been carried out in the same manner for some considerable time, with only one other fatality recorded in the last twenty years.

1.2. The ship had used this berth before and the present crew had used the same procedures for gas freeing on one previous occasion.

1.3. A copy of the procedures to be followed were emailed to the ship by the commercial operators on the 9th January 2003. (Annex 1)

1.4. The procedures were also copied to the shore contracted gas surveyors on the 9th January 2003

1.5. There is no evidence to show that these procedures were discussed onboard or whether they were followed. There are no minutes of any meetings or instructions given by the shore side gas surveyor to the crew, apart from the entries in the cargo log book.

1.6. It is unclear from the procedure who has overall control of the operation and it is assumed that the shore side contractor would normally be in control of the gas freeing operations and that the ships staff are available to assist opening ships valves, tank lids, taking regular readings, etc..

1.7. The shoreside contractor would normally lower the ventilation hose into the tank after the crew had opened the tank lid. There is no evidence to show that the crew had been instructed to lower the ventilation hose into the tank on this occasion.

1.8. There are always commercial pressures to get vessels back into service quickly and although the crew had acted independently, by lowering the ventilation hose into the tank, there is no evidence to suggest that this was due to commercial pressure.

1.9. It is therefore concluded that there was a lack of overall control of the procedures used for the gas freeing operations on this occasion.

1.10. It is also concluded that the ships crew acted independently when they lowered the ventilation hose into the tank.

2. Chief Officer

2.1. It is unclear how the Chief Officer entered the tank as both other crew members on the deck did not see what actually happened. There are three possibilities:- **One** - The Chief Officer entered the tank. **Two** - The Chief Officer was overcome and fell into the tank from the deck. **Three** - The Chief Officer slipped and fell into the tank either from the tank lid or from the top of the ladder.

2.2. **One** - The Chief Officer entered the tank.

2.3. In industry there is a term known as 'pearl diving' whereby an individual takes a deep breath and enters a tank for a particular reason, trusting to luck and his breath holding ability to get out again.

2.4. The ventilation hose is quite difficult to manoeuvre into the bottom of the tank and could easily get trapped on the mid height platform, which is approximately 4.5 metres below the tank lid opening.

2.5. Experience has shown the shore side gas engineer that the easiest way to get past this platform is to swing the hose back and forth from above the tank lid and drop it when it had swung past the platform.

2.6. Without this knowledge, it would be quite simple and tempting to 'pearl dive' to the mid height platform and push the ventilation hose past the platform edge before returning to the tank opening.

2.7. To enter an inerted tank is no doubt foolhardy, the diameter of the opening is approximately 760 millimetres, the ladder is vertical and the ventilation hose would be an obstacle to free movement.

2.8. Based on the Chief Officer's experience of gas ships, his knowledge of tank entry procedures used onboard and his experience of carrying out the same operation on this ship on a previous occasion, this method of entering the tank has been discounted.

2.9. **Two** - The Chief Officer was overcome and fell into the tank from the deck.

2.10. The tank was inerted with Nitrogen and there may have been some Nitrogen displaced by inserting the ventilation hose into the tank.

2.11. To be overcome the Chief Officer would have had to put his head very near the tank lid or into the tank.

2.12. The ventilation hose may have become entangled with the mid height platform and the Chief Officer may have looked into the tank to see

where the hose was, there is therefore a possibility that he was overcome.

2.13. The tank lid opening is 760 millimetres in diameter and is 300 millimetres above the deck, it also has a 50 millimetre flange around the rim. To lean into the tank the Chief Officer would have to kneel down onto tank coaming flange or kneel on the deck grating and look over the tank coaming into the tank.

2.14. The first part of the opening to the tank is approximately a six hundred millimetres coaming with two built in rungs, the vertical ladder immediately below this leading to the mid height platform. (Annex 2) The tank grating is approximately 400 millimetres below the coaming flange.

2.15. The tank coaming, vertical ladder and associated steel structure in the entrance to the tank would not allow for a body to turn easily when falling. If the Chief Officer fell headfirst into the tank he would most likely have hit the platform headfirst.

2.16. The injuries received by the Chief Officer, a broken elbow and a fractured cheekbone do not appear to be consistent with a headfirst fall into a tank. (Annex 3)

2.17. Whilst this is a possibility it is concluded that this method of entry to the tank is unlikely to be the cause.

2.18. **Three** - The Chief Officer slipped and fell into the tank either from the tank access hatch or from the top of the ladder.

2.19. To lower the ventilation hose into the tank the easiest method is to stand beside the tank lid or on the tank lid flange and drop the hose through the tank access hatch.

2.20. As it is difficult to lower the ventilation hose past the mid height platform by dropping the hose directly downwards, it is logical to swing it back and forth to try and drop it past the platform.

2.21. To swing the hose from above the tank lid opening is difficult as the hose is impeded by the tank access hatch coaming.

2.22. The ventilation hose could be easily snagged by the coaming, ladder, ladder supports and mid height platform.

2.23. To swing the hose a person would need to stand on the tank lid flange, the built in rungs of the coaming or the rungs of the vertical ladder.

2.24. The injuries received by the Chief Officer are more consistent with a slip or fall whereby he used his arms to break his fall, sustaining a broken elbow either on the tank lid flange or the ladder rungs built into the tank coaming.

2.25. It is concluded that the Chief Officer most likely entered the tank by slipping and falling from the tank lid flange, the built in rungs of the coaming or the vertical ladder.

3. Rescue Operation

3.1. The Third Officer acted immediately he saw the Chief Officer missing from the tank lid, he checked the tank and saw the Chief Officer lying on the mid height platform. He realised that all the hand held radios were with the personnel on deck and ran to the accommodation to raise the alarm.

3.2. On raising the alarm, most of the officers and crew assembled on deck and assisted in the rescue operation. The rescue was carried out professionally and without delay, the whole operation taking approximately five minutes to complete.

3.3. The Second and Third Mates administered first aid efficiently and effectively to the Chief Officer by giving him oxygen as they had found a heartbeat and he recovered.

3.4. The Ordinary Seaman-Messman had the presence of mind to bring an additional breathing apparatus set from the wheelhouse where he had mustered on hearing the alarm. The OSM donned this BA set and entered the tank to rescue the AB again with the rope to pull him out.

3.5. Once rescued the second mate attempted to resuscitate the AB but found no pulse or heartbeat and started CPR until the shore side rescue services arrived.

3.6. The quick arrival of the shore side rescue services was due to the quick actions of the shore side gas engineer who had called them on hearing that someone was in the tank.

3.7. It is concluded that the officers and crew carried out the rescue operation efficiently and effectively.

3.8. It is concluded that the quick actions of the third mate and AB saved the Chief Officer's life, however the death of the AB was an unforeseen accident and unfortunate under the circumstances.

3.9. It is also concluded that rescue drills are very important, as shown here, when they have to be put into practice what they have learnt.

4. AB

4.1. How the AB fell in the tank is unknown due to the Chief Officer's body obscuring the view into the tank. There are a number of possibilities:- **One** - The mask of the AB's breathing apparatus was not fitted correctly or was knocked off, he was overcome and fell. **Two** - The AB slipped and fell when the Chief Officer was pulled out of the tank.

4.2. **One** - The mask of the AB's breathing apparatus was not fitted correctly or was knocked off, he was overcome and fell.

4.3. The second engineer assisted the AB to fit the breathing apparatus set and the normal checks for sealing the facemask and operation of the set were carried out prior to the AB entering the tank.

4.4. When the Ordinary Seaman-Messman entered the tank to rescue the AB, the OSM found that the AB's facemask was loose along with the straps of the breathing apparatus.

4.5. The OSM had to loosen the straps further to attach the rope and as the AB was pulled from the tank the breathing apparatus fell back into the tank onto the mid height platform.

4.6. It is concluded that the facemask was fitted correctly prior to the AB entering the tank and that the facemask became loose whilst he was inside the tank. It may have been dislodged during the rescue of the Chief Officer or more likely when he fell.

4.7. **Two** - The AB slipped and fell when they pulled the Chief Officer out of the tank.

4.8. The AB was assisting the rescue of the Chief Officer from below, he was in a confined space, working on a vertical ladder guiding the Chief Officer's body up the ladder ensuring it was not caught on the rungs or the tank coaming. The AB would have to use one hand to hold onto the ladder and the other to guide the body.

4.9. The tension was steady on the rope until the Chief Officer was at the tank lid where the officers and crew could then manhandle him out and away from the tank.

4.10. The sudden movement of the Chief Officer's body being lifted out of the tank could have unbalanced the AB causing him to fall.

4.11. It is concluded that, without further evidence coming to light, this is the most likely reason for his fall.

5. Draft Report

5.1. A draft copy of this report was forwarded to the Hanseatic Shipping Company, Cyprus and their comments have been incorporated in this report where appropriate.

3. Conclusions

1. There was a lack of overall control of the procedures used for the gas freeing operations on this occasion.

2. The ships crew acted independently when they lowered the ventilation hose into the tank.

3. The Chief Officer most likely entered the tank by slipping and falling down the vertical ladder.

4. The officers and crew carried out the rescue operation efficiently and effectively.

5. The quick actions of the third mate and the AB saved the Chief Officer's life.

6. The death of the AB was an unforeseen accident and unfortunate under the circumstances.

7. The facemask of the AB's breathing apparatus became loose whilst he was inside the tank and this was most likely due to his fall.

8. The AB most likely slipped and fell during the rescue of the Chief Officer.

9. That the practising of rescue drills from enclosed spaces is a very important function, as was shown in this case.

4. Recommendations

1. The procedures for gas freeing should be rewritten to show who has overall control of the operation. It may also be prudent to reconsider the manner in which the air hose is put into the tank.

2. The procedures should clearly state what is expected from shore and/or ships personnel and who is responsible for each action.

3. The shoreside - ship interface should be confirmed in writing, minuteted or on checklists, prior to commencement of the operations.

4. No one should assist in operations without confirmation of the personnel in charge.