Marine Safety Investigation Unit

Transport Malta

SAFETY INVESTIGATION REPORT

201706/022 REPORT NO.: 12/2018 June 2018

MV *MSC RAVENNA*
Fatal fall overboard of a crew member in the port of M'Xlokk 22 June 2017

SUMMARY

MSC Ravenna entered the Malta Freeport and berthed starboard side alongside at Terminal 2, North quay on Wednesday 21 June 2017 at 1924. During her cargo discharge operation, the vessel was to bunker 700 metric tonnes of high sulphur fuel oil from a local bunker barge.

Two six inch diameter bunker hoses, connected together, were lifted using the vessel's port side provisions crane and the bunker hose flange was connected to a reducer stub piece at the manifold.

When the bunkering operation was terminated, the fitter and the wiper started to release the bolts of the reducer flange to which the bunker hose was tightened. As soon as the bunker hose flange was clear off the last bolt, the fitter was pulled backwards, still bracing the bunker hose as it swung towards the shipside. He eventually lost his balance and fell overboard to the bunker barge, sustaining fatal injuries.

The MSIU has issued one recommendation to the Company designed to ensure that the bunkering area remains safe for the crew members during bunkering operations.

MSC Ravenna

FACTUAL INFORMATION

Vessel

MSC Ravenna, a 153,115gt fully cellular container ship (Figure 1) was built in 2011 and was registered in Liberia. She was owned by CPO Ancona Offen Reederei, managed by CPO Containerschiffreederei GmbH & Co. KG of Hamburg and classed with DNV GL.

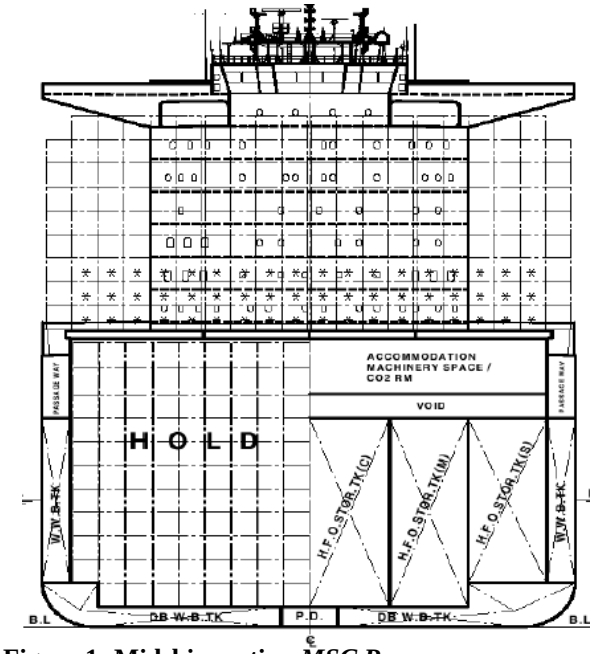

Figure 1: Midship section *MSC Ravenna*

The vessel had length overall of 365.79 m, a moulded breadth of 51.20 m and a moulded depth of 29. 90 m. The vessel had a summer draught of 16.00 m and a corresponding deadweight of 165.963 tonnes.

Propulsive power was provided by a 12-cylinder MAN B&W 12K98MC-C, two stroke, slow speed direct drive diesel engine producing 72,240 kW at 104 rpm. This drove a single, fixed pitch propeller, reaching a service speed of 24.0 knots. The vessel was fitted with a periodically unattended machinery space.

Crew

MSC Ravenna's minimum safe manning certificate required a crew of 13. There were 29 crew members on board, including two cadets. The crew members were mainly Filipinos, although there were a number of Polish and Ukrainian citizens.

The fatally injured crew member was a 57 year old Filipino and was signed on the vessel as a fitter. He first went to sea in 1993 and had always sailed as a fitter. He had been serving with the Company for about 18 years. He had been on board for four months, having joined *MSC Ravenna* on 22 February 2017 in Singapore.

The wiper, who was accompanying the fitter, was 41 years old and had been employed with the Company since 2011, always working in the same rank.

Environment

The wind was Southwesterly, force 3 to force 4, slight sea and negligible swell. Air temperature was 25 °C whereas sea temperature was recorded at 24 °C.

Narrative[1]

MSC Ravenna entered the Malta Freeport and berthed starboard side alongside at Terminal 2, North Quay on Wednesday 21 June 2017 at 1924. The vessel had left Singapore on 08 June 2017 and after discharging in Malta, her scheduled next port of call was Barcelona, Spain.

During her cargo discharge operation, the vessel was to bunker 700 metric tonnes of high sulphur fuel oil. A local bunker barge, *Balluta Bay*, arrived alongside *MSC Ravenna* at 2030 and moored with her port side alongside the container vessel's port side (Figures 2 and 3).

[1] Unless otherwise stated, all times are local (UTC +1).

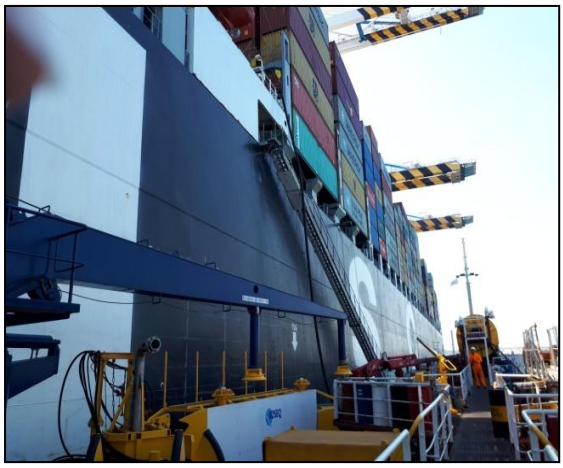

Figure 2: *MSC Ravenna* and *Balluta Bay* alongside

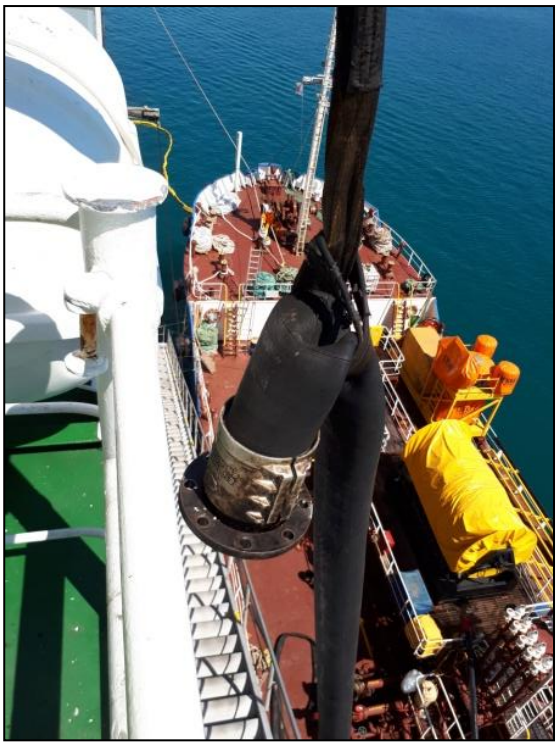

Figure 3: *Balluta Bay* alongside with lowered accommodation ladder

The chief engineer designated the third engineer, the fitter and the wiper to man the bunker station. Two six inch diameter bunker hoses, connected together, were lifted using the vessel's port side provisions crane, which had a safe working load (SWL) of four tonnes. The hoisting and connection of the bunker hose to the port side bunker manifold at deck A was handled by the container vessel's engine-room team. The bunker hose flange was connected to a reducer stub piece (6 inch : 8 inch) at 2215 (Figure 4).

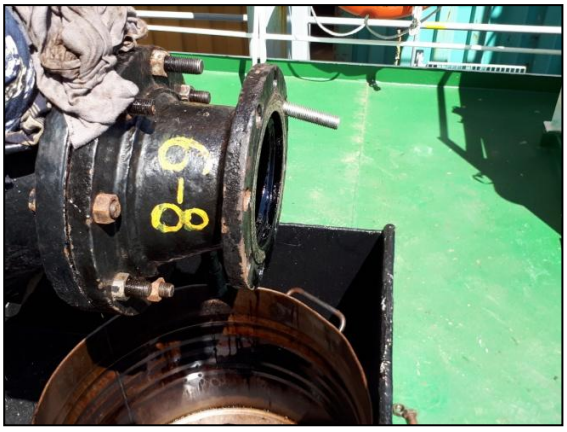

Figure 4: Reducer stub piece

The bunker hose was supported at the ship's side, abreast of the manifold, by passing it over a round bar, fitted in a fore and aft axis along the shipside railing (Figure 5) to protect it from sharp edges and obstructions.

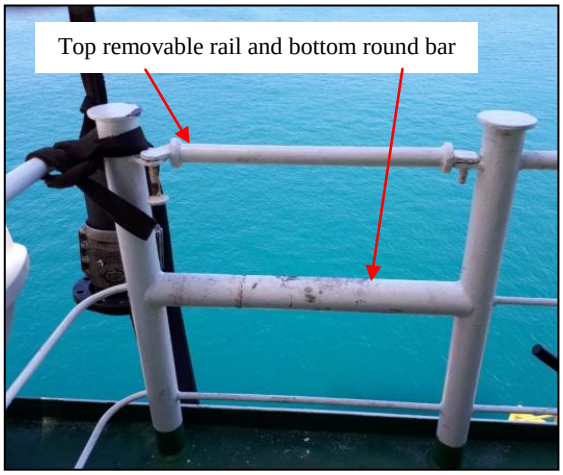

Figure 5: Railing at the port side bunker station

Moreover, in order to avoid excessive weight at the bunker station manifold, the bunker hose was also supported by a single point flat strap, using the ship's provision crane, set at about two metres from the manifold reducer.

The 700 metric tonnes fuel oil stem had to be transferred to the HFO storage tank, which had a capacity of 2172.6 mt (98% full). The fuel

oil tanks soundings recorded by the chief engineer on 21 June 2017 at 1924 (before commencement of the bunkering operations) indicated that the HFO storage tank contained about 14 mt of HFO. The quantity ordered could easily be accommodated in the HFO storage tank).

Pumping commenced at 2245 and was stopped at 0230 on (Thursday, 22 June 2017). Tanks' soundings on the bunker barge *Balluta Bay* and on board *MSC Ravenna* were verified with the assistance of an attending bunkering surveyor to confirm the quantity delivered by the bunker barge. An agreement was reached and the bunker deliver note was signed for the delivery of 669.53 mt.

In the meantime, the fitter and the wiper resumed duty at 0230 on Thursday, 22 June 2017, having both been sent to rest earlier at midnight. At around 0415, the chief engineer of the *MSC Ravenna* instructed them to disconnect the bunker hose. At that point in time, both the fitter and the wiper were at the bunker station awaiting orders.

The fatal fall overboard

The fitter and wiper started to release the bolts of the reducer flange to which the bunker hose was tightened. During the process, the wiper was situated inboard of the manifold with his back to the accommodation block while the fitter was on the outboard side of the bunker manifold with his back to the shipside.

Together they removed seven out of the eight bolts between the bunker hose and the reducer flanges. The last bolt (Figure 6) was slackened and before releasing the last nut, the fitter instructed the wiper to be careful not to get injured should the bunker hose swing towards him as soon as it was freed.

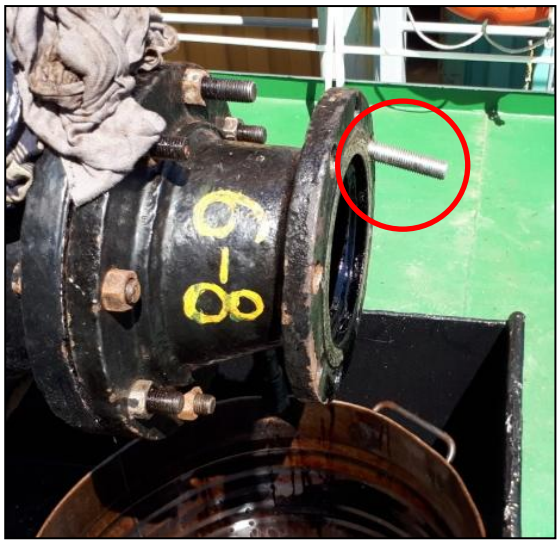

Figure 6: Last bolt still in place after the accident

While the wiper unscrewed the last nut, the fitter grabbed the six inch bunker hose under his right arm. He was still facing the wiper with his back to the ship side. The wiper completely unscrewed the nut from the last bolt and the fitter eased the bunker hose flange from the bolt's threaded length.

As soon the bunker hose flange cleared the bolt, the wiper saw the fitter being pulled backwards and still bracing the bunker hose as it swung towards the shipside (Figure 7).

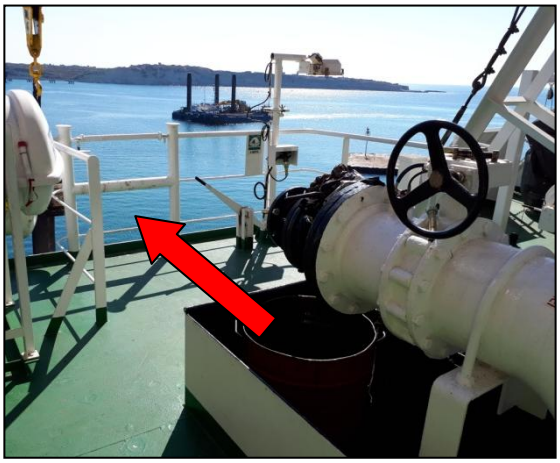

Figure 7: Direction in which the fitter was being pulled

At the edge, the fitter lost his balance when his legs hit the horizontal pipe for the bunker hose support (bottom round bar in Figure 5). The

fitter was observed releasing his hold on the bunker hose, toppling backwards, and falling overboard.

The wiper shouted the fitter's name as he lost sight of him. Before realising what was actually happening, the wiper heard a bump-sound and went to look over the ship side. He saw his colleague stretched motionless on the main deck of the bunker barge besides the cargo crane.

In shock, the wiper momentarily froze but then ran inside the accommodation to the chief engineer's office to inform him of the accident. The chief engineer office is on Deck 'A', the outermost cabin on port side, looking forward. The chief and second engineer came running out and peered over the port ship side railing. Immediately, the chief engineer notified the master.

Witness on *Balluta Bay*

The deck manning on board *Balluta Bay* comprised a master, a master / chief officer, chief officer and a second officer.

The master / chief officer on *Balluta Bay* had been on cargo watch since 2200 of Wednesday 21 June 2017. At 0400, he was joined on deck by AB1. The master / chief officer was still awaiting instructions from the chief engineer of *MSC Ravenna*. He had not been informed by *MSC Ravenna* engineers that the bunker hose was going to be disconnected.

At the time of the accident, the master / chief officer and the AB1 were on the catwalk a few metres aft of the bunker barge cargo manifold. The swinging bunker hose attracted their attention. However, the master / chief officer also observed a person falling over the shipside and hitting the accommodation ladder's railing.

The port side accommodation ladder of *MSC Ravenna* was lowered between both vessels' port sides, onto the *Balluta Bay* in order that *MSC Ravenna*'s engineers could access the bunker barge and control the tanks' soundings (Figure 8).

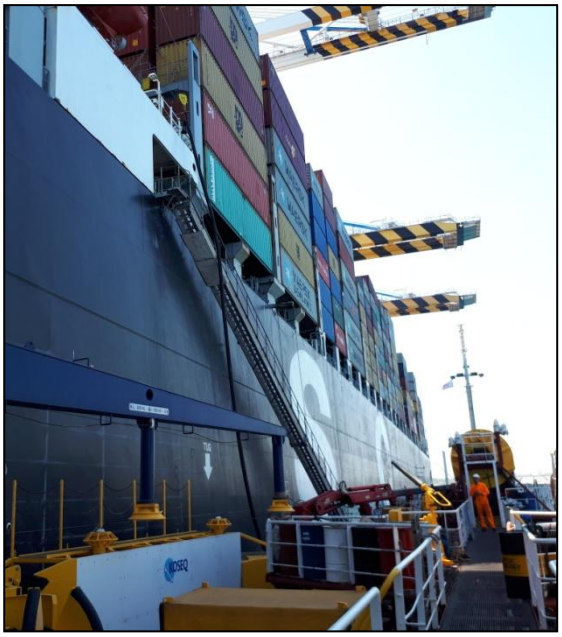

Figure 8: Accommodation ladder to the bunker barge

It was observed that the person who fell overboard from the container vessel landed on the deck of the bunker barge, close to the deck crane. The duty officer immediately informed the barge master, who at the time was in his cabin. Both rushed out on deck to the scene of the accident. It was observed that the person was motionless, bleeding from the head and mouth, and exhibited no pulse.

At 0434, the master on *Balluta Bay* notified Marsaxlokk Port Control on VHF channel 14. At 0450, the Malta Freeport Terminal duty manager and a paramedic boarded the bunker barge. After examining the fitter, the paramedic informed the master that the person was dead.

At 0510, an emergency shore medical response team arrived on the scene and took control of the situation.

Company bunkering procedure

The Safety Management System of CPO Containerschiffreederei GmbH & Co. KG defined bunkering operations in the *Bunkering / Oil Transfer Procedure VA-020* revision 1 with issue date 14.10.2016. Amongst the detailed instructions written in the procedure, were the following key elements:

3. Responsibilities

The engine crew under the management of the Chief Engineer is responsible for bunkering and oil transfer. If certain tasks are delegated, they should be monitored and checked by the Chief Engineer. The Master should always be aware of these responsibilities.

4. Resources

4.1 Human Resources

The personnel involved in this process are qualified for and familiar with this task. Requirements are laid down in the functional descriptions. All crew involved in bunkering operation are adequately rested as per applicable regulations.

5. Description of Routines

5.1 Bunker routines

- *Before, during and after bunkering, the Checklist CL-014 is to be rigorously followed;*
- *In case of accidents, the appropriate Emergency Response Plan is to be implemented.*

5.5 Safety Precautions during Cargo Operations

- *When and where possible, bunker barges should be secured alongside the vessel's accommodation.*

5.7 Training prior to Oil Transfer

The Chief Engineer is conducting a training with all crew involved (incl. deck rover). The training should address determined Pre-loading plan, Vessel oil Transfer procedure, Monitoring routines, English phrases hand signals for communication and Emergency shutdown procedures as well as applicable Civil/Criminal penalties and liabilities.

The Pre-loading Plan should include but is not limited to:

- *Identification, location, capacity of tanks receiving oil;*
- *Level, type of liquid in each bunker tank prior to scheduled bunkering;*
- *Planned final ullage, and planned final percentage of each to be filled;*
- *Sequence of tanks to be filled;*
- *Procedure to monitor all bunker tank levels and valve alignments;*
- *Awareness about risks, recognising, monitoring and exposure of hydrogen sulphide.*

The pre-bunkering training shall be logged into the vessel log book and documented by training participant list.

On board training

Shipboard familiarisation training was carried out two days after joining the vessel in accordance with the vessel's SMS procedures.

Both the fitter and the wiper had been provided with shipboard familiarisation training by the third officer, upon joining *MSC Ravenna*. The required Familiarisation Form CL-019 was also countersigned by the master. Shipboard familiarisation training for the fitter was completed on 23 February 2017, while the wiper's checklist was signed on 10 May 2017.

Documentary evidence indicated that the chief engineer had organised a training session with a number of crew members who were to be involved in the bunkering operation at Marsaxlokk. The training on bunker preparation and procedures, and SOPEP procedures to be applied during the bunkering operation was carried out by the chief engineer on 20 June 2017, while the ship was at sea.

The Training Participants Form Fo-013 had been completed and demonstrated that all the engine-room personnel had participated in the preparation for the bunkering operation. Prior, during and after the bunkering operation, the Checklist Form CL-014 was completely filled, signed and dated by the responsible person and the chief engineer.

ANALYSIS

Aim

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, and to prevent further marine casualties or incidents from occurring in the future.

Cooperation

During the course of this safety investigation, MSIU received all the necessary assistance and cooperation from the Deputy Commissioner of Maritime Affairs, Liberian Registry.

Environmental conditions

Evidence suggested that there was adequate artificial illumination at the port side bunker station at deck A for the fitter and wiper to perform the disconnection of the bunker hose safely.

It had also been established that the fitter and wiper were wearing the necessary personal protective equipment to carry out the job entrusted to them. Moreover, the appropriate tools were used to disconnect the bunker hose from the reducer piece to which the bunker hose was bolted.

The weather conditions at the Malta Freeport were clear, with variable wind. The deck at the bunker station was not slippery. No sudden movement or list on board *MSC Ravenna* was reported and which could have caused the fitter to lose his foothold and slip.

Dynamics of motion and forces

The distance between the 6 inch flange at the bunker station reducer piece and the shipside railing was about 3.5 m.

During the course of the on board safety investigation, the master was requested to temporary remove the weight of the bunker hose from the crane hook, without slewing or luffing the provisions crane. The bunker hose was momentarily secured to the shipside railing post.

The paid-out wire of the crane was allowed to settle at its natural vertical position, in line with the provisions jib head. It was noticed that the resting position of the crane hook was closer to the shipside railing than the reducer flange (Figure 9).

Figure 9: Position of the crane hook at rest (after the bunker hose was removed)

The length of the paid-out wire was calculated to be approximately 13 m (the height of about five containers) from the jib's head to the crane hook (Figure 10).

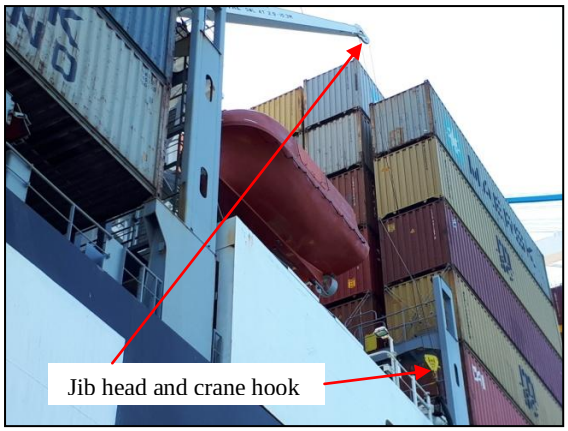

Figure 10: Paid out wire length from the jib head to the crane hook

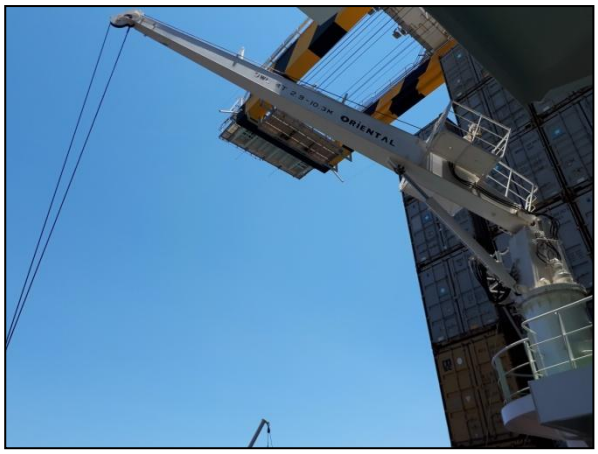

Figure 11: Port side provisions crane

It was evident that once the bunker hose flange was disconnected from the reducer, a pendulum effect was created. The suspended weight of the bunker hose oscillated towards the shipside as a result of the force acting in that direction, pulling the fitter in the same direction. The restraining force of the fitter could not counteract the swing of the wire rope.

During the bunkering operation, the top hinged shipside railing (Figure 5) had been opened and hooked to the railing, forward of the liferafts. When the fitter's back legs hit the bunker hose support bottom round bar, he lost balance, released his hold on the bunker hose, fell backwards and overboard on to the bunker barge. The provisions crane wire with the suspended bunker hose came to rest on the outboard side of *MSC Ravenna*'s shipside railing.

Jib head position in relation to the shipside

The safety investigation also took into consideration as to whether it would have been possible for the crane hook not to rest outside the shipside when the suspended below the jib head.

Adjustment of the jib length was not possible because the jib was of a fixed length (Figure 11).

Since this provisions crane was regularly used for bunkering operations, it was not excluded that the angle of the jib (as set) was considered to be the most ideal one to support the bunker hose length from the ship side to the bunker manifold.

Technically, it was possible for the jib to be slewed further inboard to minimise (or neutralise) the component of the force created by the bunker hose, hanging from the shipside. However, the crew members had no cues that the bunker hose would swing to an extent that it would have pulled the crew member over the side[2]. Then, all previous bunkering operations were carried out in a similar manner and no accidents or incidents had been reported to the Company.

Reaction *versus* instinct

The wiper recalled that the accident happened within a couple of seconds and the fitter's immediate action was to hold the bunker hose to prevent its movement while being disconnected. His reaction, as the bunker hose swung towards the shipside, dragged him towards the edge.

[2] This is discussed in more detail in the sub-section 'Bunker checklist – problem detection and identification'.

Bunker checklist – problem detection and identification

As expected, the bunker checklist communicates the necessary preparations and execution of the bunker plan. The bunker / oil transfer checklist was part of the safety management system addressing three sequential time frames of the bunkering operation:

1. Prior to bunkering;
2. Whilst bunkering; and
3. After bunkering.

As expected, the checklist's main focus was the prevention of marine pollution and bunker oil specifications. Two items (no smoking sign and fire extinguisher at the bunker station) were included in the checklist and may be considered as pertaining to the safety aspect of the bunkering operation.

It was also noticed that the connection and disconnection of the bunker hose was addressed in:

- Time frame (1) – "supervise proper connection of the hose"; and
- Time frame (2) – "disconnect hose, put blank flange, redeliver to bunker barge / truck."

Academic literature makes a distinction between problem detection and problem identification.

Problem detection happens when cues are strong enough to start raising a concern. Problem identification, however, happens when the actual problem is specified. If the disconnection of the bunker hose is seen sequentially, it would appear that there were two stages:

1. The unscrewing of the last nut; and
2. The release of the bunker hose flange from the threaded length of the bolt.

An analysis of the actions by the fitter, as witnessed by the wiper, suggested that the cautioning, which the fitter made to the wiper, was indicative that the expectancy which was generated was not accurate. This was so because the swing was in the direction of the fitter rather than the wiper.

The detection of a potential problem had been compromised because the cue (that the bunker hose would swing towards the vessel's side) had not been detected. Then, when the actual swing started (soon after the flange cleared the threaded bolt), the time was too short for the fitter to understand the dynamics of the swing and how it was going to pull him (dangerously) towards the opening in the railing.

Missing physical barrier systems

It may be considered that the open hinged bar was actually a missing physical barrier system, which could have prevented the fatal fall from happening.

Rather than being forgotten, a closer analysis of the situation revealed that it was normal for the hinged bar to be left open during bunkering operations; this would permit the bunker hose to be guided over the ships side and pulled on deck towards the bunker manifold.

Figure 12 indicates that the bottom round bar carried markings made whenever the bunker hose is pulled over it. However, it may also be noticed that the top removable rail is clean and free from any markings, suggesting that it is always out of the way during bunkering operations.

The distance between the bottom round bar and the top removable rail was small (even less than the distance between the deck plating and the bottom round bar). To this effect, the curve of the bunker hose at the ship side did not permit the top removable rail to be put back in place when the bunker hose is connected to the bunker manifold on board.

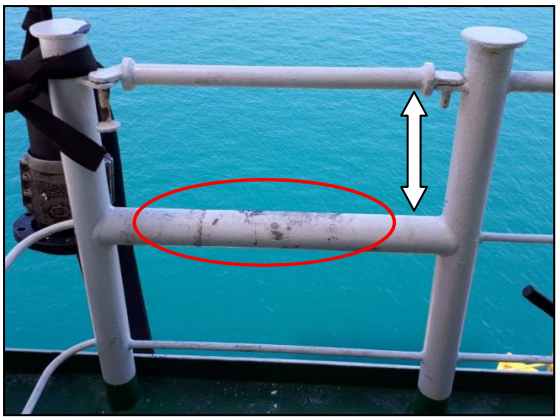

Figure 12: Bunker hose markings on the bottom round bar

CONCLUSIONS

1. As soon the bunker hose flange was cleared from the reducer's last bolt, the crew member was pulled towards the ship's railing and overboard;

2. The suspended weight of the bunker hose oscillated towards the shipside as a result of the force acting in that direction, pulling the fitter in the same direction;

3. The restraining force of the fitter could not counteract the swing of the wire-rope;

4. During the bunkering operation, the top hinged shipside railing had been opened;

5. When the fitter's back legs hit the bunker hose support bottom round bar, he lost balance, released his hold on the bunker hose, fell backwards and overboard on to the bunker barge;

6. The crew members had no cues that the bunker hose would swing to an extent that it would have pulled the crew member over the side;

7. The two crew members at the bunker station did not expect the bunker hose to swing outboard;

8. When the actual swing started (soon after the flange cleared the threaded bolt), the time was too short for the fitter to understand the dynamics of the swing and how it was going to pull him (dangerously) towards the opening in the railing;

9. The open hinged bar was actually a missing physical barrier system;

10. The curve of the bunker hose at the ship side did not permit the top removable rail to be put back in place when the bunker hose is connected to the bunker manifold on board.

RECOMMENDATIONS

CPO Containerschiffreederei GmbH & Co. KG is recommended to:

12/2018_R1 re-design the railing section in way of the bunker hose access point to ensure that the area remains safe for the crew members attending the bunkering operation.

SHIP PARTICULARS

Vessel Name:	*MSC Ravenna*
Flag:	Liberia
Classification Society:	DNV GL
IMO Number:	9484431
Type:	Container
Registered Owner:	CPO Ancona Offen Reederei
Managers:	CPO Containerschiffreederei GmbH & Co. KG
Construction:	Steel
Length Overall:	365.79 m
Registered Length:	351.77 m
Gross Tonnage:	153,115
Minimum Safe Manning:	13
Authorised Cargo:	Containers

VOYAGE PARTICULARS

Port of Departure:	Singapore, Singapore
Port of Arrival:	Marsaxlokk, Malta
Type of Voyage:	International
Cargo Information:	6,803 TEUs
Manning:	29

MARINE OCCURRENCE INFORMATION

Date and Time:	22 June 2017 at 0425 (LT)
Classification of Occurrence:	Very Serious Marine Casualty
Location of Occurrence:	Marsaxlokk, Malta
Place on Board	Freeboard deck
Injuries / Fatalities:	One fatality
Damage / Environmental Impact:	None
Ship Operation:	Alongside/moored/loading/bunkering
Voyage Segment:	Arrival
External & Internal Environment:	West to Southwesterly Force 3 to 4 winds and good visibility. Slight sea and negligible swell.
Persons on board:	29