

Consolidated Version – Occupational Accidents

OCCUPATIONAL ACCIDENT (III 5)

Very serious casualty: Fatal fall from height

What happened?

The bosun of a 36,000 GT bulk carrier was fatally injured when he fell about 6 metres from a cargo crane grab while preparing to descend from the grab where he had been working. The ship was carrying a cargo of coal and was at sea. A number of its crew had been tasked to replace the wire rope of a cargo crane grab stowed on its stowage platform on the main deck. The weather was fair and working at height precautions, including completing a ship's "permit to work aloft", had been taken.

The work started in the morning and was completed in the evening. Two seafarers first descended from the grab. The bosun then prepared to descend. Shortly after unclipping his safety harness lanyard, he lost his footing and fell about 5 metres onto the platform railing and a further 1 metre onto the deck below. He suffered a head injury. The bosun was given first aid, moved to the ship's hospital and the ship's master sought radio medical advice. However, he died about an hour after the accident.

Why did it happen?

The bosun lost his footing just after unclipping his safety harness to descend from the grab. The ship's procedures did not refer to hazards related to access/egress from a worksite at height, and it could not be determined if the risk of going up and down from the grab had been assessed.

The shape, size and position of the grab meant poor hand and foot holds, and it was concluded that the bosun probably perceived the risk involved as acceptable and within his control. The fall prevention equipment on board was not ideal for vertical movements, whereas the use of equipment such as a double-legged energy absorbing lanyard would have been more appropriate. The equipment was of a type that necessitated unclipping the safety harness lanyard to ascend or descend the worksite.

What can we learn?

- Suitable fall prevention equipment, such as a double-legged energy absorbing lanyard, should be provided on board ships to adequately address the risk of falling from height.
- Shipboard procedures and permits to work at height should address the risk of falling at all stages of the work, including the risk when ascending/descending the worksite.
- An objective and robust risk assessment process can ensure individual risk perception of working at height is not a factor.

Seafarers should recognize the dangers of unclipping prematurely and not disconnect their safety devices until such time as they are in a safe position to do so.

Who may benefit?

Seafarers, shipowners and operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious casualty: Crew member falls from a ladder during hold cleaning operations

What happened?

Hold-cleaning operations were being conducted during a ballast voyage in the East China Sea. The weather conditions were favourable – Force 3 wind and a low swell. The crew were using a high-pressure washer to remove previous cargo residue from the sloping bulkhead that formed part of the hold hopper construction. The crew were using a ladder resting flat against the sloping bulkhead to access the upper portion of the bulkhead.

The ladder was secured by rope at the top and was being supported by a crew member at the bottom. A crew member then scaled the ladder and directed the waterjet onto the bulkhead to remove the cargo residue. While on the ladder the crew member was supported by a safety line that was attached to his safety harness. The safety line led through a pad eye on the bulkhead above and was controlled by another crew member from the tank top below. This was a long-established method for cleaning the cargo hold.

In this case the crew member on the ladder was climbing down to the tank top in order to reposition the ladder for the next section. The crew member was about 1 metre from the tank top when he stopped and disconnected himself from the safety line. He then immediately lost his balance and fell backwards onto the tank top, striking his head, and became unconscious.

The injured crew member was evacuated by helicopter. However, despite the first aid efforts of the crew and the medics on board the helicopter, he was declared dead on arrival at the hospital. The cause of death was attributed to a head injury.

Why did it happen?

The crew member disconnected himself from the safety line before he reached the tank top.

The crew member's safety helmet was not secured by the chin strap and dislodged during the fall. Although this factor did not cause the accident, had the helmet remained attached to his head it could have provided sufficient protection to lessen his injuries from a fall from such a relatively low height.

What can we learn?

- Even falls from low or moderate heights can result in serious injury or death. Seafarers should not become complacent about the dangers of working at height, particularly when using ladders.
- Seafarers should recognize the dangers of unclipping prematurely and not disconnect their safety devices until such time as they are in a safe position to do so.
- A hard helmet will provide a greater level of protection if it is secured by a chin strap.

There is an element of risk when seafarers are working with ladders of any description. While ladders are necessary for providing access, it is not considered good safe industry practice to use them as a work platform.

Who can benefit?

Seafarers, ship managers, shipowners, ship operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious casualty: Crew member falls overboard while lashing log cargo in port

What happened?

A bulk and log carrier was loading logs at an anchorage. Loading logs on deck above number one hold were complete. The ship's crew were lashing the logs above number one hold while loading continued at other holds.

While lashing, one of the ordinary seamen fell overboard into the sea. Another member of the deck crew jumped into the water to search for the ordinary seaman. Despite an extensive search over several days, involving several other vessels, the ordinary seaman was never found.

Why did it happen?

What caused the ordinary seaman to fall overboard was not established. He was wearing coveralls, gloves, a safety helmet and studded overshoes.

The ordinary seaman was not an experienced seaman and, not only was he not experienced in log lashing operations, he had received no training or briefing from senior crew members as to the risks involved in working on log stacks.

No guard lines or rails had been erected and nor was the ordinary seamen wearing a safety harness attached to an appropriate fall arrestor, so there was nothing to prevent or arrest his fall when he fell from the log stack.

The ordinary seaman was not wearing a lifejacket or buoyancy aid to aid his survival when he fell into the sea.

Nothing in the ship's SMS manual required the crew to rig safety lines or wear safety harnesses when working on top of log stacks.

What can we learn?

- Working on top of log stacks is a potentially hazardous operation that involves working at height. Crew need to take all necessary precautions to mitigate the risks involved.
- When working at height on top of log stacks, crew should be protected at all times by either guard lines or safety harnesses attached to an appropriate fall arrester system.
- When working near the side of the vessel on top of a log stack, crew should be wearing an appropriate buoyancy aid to improve their chances of survival should they fall overboard.

- The company should identify and assess all risks to its ships and personnel, and establish appropriate safeguards based on robust hazard identification and risk assessment. All necessary safeguards should be addressed through procedures in the ship's SMS.

Who can benefit?

Seafarers, ship managers, shipowners, ship operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious marine casualty: Crew member hit by crank handle

What happened?

A 16,000 GT bulk carrier was waiting at the anchorage for berthing when the ship's crew were involved in a routine abandon ship drill. The enclosed davit-launched lifeboat was being recovered when it failed to operate. The ship's electrician was summoned to the boat deck to identify the reason for the winch controller's failure. In the interim, the master instructed the bosun, ordinary seaman (OS) and another crew member to recover the boat manually. The crew inserted the manual crank handle to hoist the boat. The electrician, on being told by the bosun about the motor, went to the switch board location to restore the power. At the lifeboat deck, the motor started to turn. Along with it, the manual crank handle, which was still inserted into the hoisting slot, turned a few rounds and hit the bosun and the OS who were standing in close proximity to the handle. The bosun received injuries to his skull as the rotating handle struck his head while the OS sustained minor bruising to his hip. The bosun succumbed to his injuries on board.

Why did it happen?

The lifeboat's electrical system was found to have been bypassed to overcome an inoperable or malfunctioning limit switch so as to facilitate the winch motor to operate. In order to restore the power, the electrician had to bypass the existing jumper or short circuit, thereby compromising the safety interlock which was designed to prevent accidents. During this process the lever for hoisting remained engaged in the stowed position while the bosun and the crew continued to hoist the boat manually using the manual crank handle. This condition allowed for the winch to operate when the electrician restored power to the breaker.

The crew on board the vessel were not well versed with the interlocking system of the lifeboat. Although the manual and drawings of the lifeboat system contained instructions and warnings, there were no warnings at the operation area to warn the users of hazards that may occur during launching / recovery of the lifeboat.

There was inadequate supervision of the boat deck when the officer in-charge left the station to look for the electrician. A routine drill recovery process was not upgraded to a high-risk operation when the hoisting mechanism failed to operate.

Despite the conduct and participation of crew in routine and regular safety drills, familiarity of alternative recovery modes was not routinely exercised.

What can we learn?

- Crew must fully understand the operating mechanism of the equipment on board the ship and ensure that safety interlocks are not bypassed under any circumstances.

- Work performed by shore contractors should be supervised by the ship's staff and verified.
- Procedures in the SMS for the operation and maintenance of ship's systems and equipment should take into account the recommendations and hazard warnings provided by the manufacturer.
- Alternative modes for recovery of survival craft should be regularly incorporated into mandatory drills.
- The benefits of pre-briefings and debriefing of the crew in relation to mandatory drills should not be underestimated for crew training and familiarization.

Who may benefit?

Seafarers, shipowners and operators, ship designers.

OCCUPATIONAL ACCIDENT (III 5)

Very serious marine casualty: Crew member hit by falling plate

What happened?

A 12,000 GT chemical/products tanker was waiting at the anchorage for her next port orders, on completion of loading of chemical.

The engine-room crew commenced preparation for some fabrication work. The work involved shifting of steel plates to the engine-room workshop to fabricate rail guards for the ship's crane.

The 11 plates had been stowed vertically against an engine-room structure in the compartment next to the steering gear room, and held together with steel cables to prevent them from falling down. Three personnel from the engine-room, of which two were engineer officers and one an engine-room seaman, began removing the steel cables. As the cables were removed, the vessel experienced some rolling as a result of beam seas and the plates fell towards the crew.

While the two officers stationed at each end of the plate managed to move out of the way of the falling plates, the seaman who was in the middle of the plates could not. The plates, weighing about 900 kg, fell on the seaman causing multiple injuries. The seaman was evacuated from the engine-room using a stretcher and transferred to a speed boat arranged by the agent to be taken ashore for treatment. Attempts to resuscitate the seaman were unsuccessful and he died of his injuries on the way to the hospital.

A tool box meeting had been conducted by the team prior to the task.

Why did it happen?

The vessel had anchored at the outer anchorage awaiting orders. The anchorage did not offer protection from seas and swells as compared to the inner bay anchorage. Although the harbour rules conveyed through the agent to the vessel instructed vessels not to perform dangerous tasks that required movement of heavy equipment due to the open nature of the anchorage, the tool box meeting conducted by the vessel's crew did not take account of the location where the vessel was so that appropriate risk mitigating measures could be implemented to minimize the risk of injury if the task had to be undertaken.

The steel plates were stowed in the vertical position with a small inclination angle, instead of the horizontal position (flat on deck), causing risks of the plates falling abruptly when the cables used to secure them were released.

What can we learn?

- Ship management companies' safety management system procedures regarding the planning and carrying out of the activities of storage and movement of weights on board, associated tool box meetings and risk assessments should be reviewed and take into account the vessel's location in port and at sea.
- Crew should be aware of risks associated with jobs on board which may appear not to be hazardous and adopt safe work practices at all times.

Who may benefit?

Seafarers, shipowners and operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious marine casualty: Crew member caught by rope

What happened?

A 21,000 GT chemical/products tanker was approaching the berth under pilotage with the assistance of tugs. The forward tug was to be released from the tanker's bow as the vessel was required to turn to starboard. The tug line's eye had been secured to the bollard on the forecastle. The eye had a messenger rope attached to it. The tug's line was slackened to facilitate its release.

The ordinary seaman (OS) eased the rope out through the closed chock (Panama Lead) and had taken a turn of the messenger rope around the bits. As the tanker's turn to starboard for berthing continued, and the tug's line was in the water, the messenger rope's exit speed from the closed lead started to increase.

The officer in charge of the mooring operation warned the OS to step clear from the messenger rope. The OS moved between the bits from port side to the starboard side, as the rope's speed around the bitt quickened. He fell on the deck and was dragged with the rope entangled around his leg. His body hit a structure near the single point mooring chain stopper before he was dragged overboard through the Panama Chock. The OS was recovered from the water by the tug boat, and received first aid and CPR. Emergency services subsequently transported the OS to hospital, but the OS died the next day.

Why did it happen?

The messenger rope's speed increased as a result of the increasing separation between the vessel due to the vessel's sternway and moving away from the tug's position, thereby increasing the relative distance between the two vessels. This increased speed of the messenger rope was not anticipated by the crew of the vessel, as the OS continued to hold on to the messenger rope's end.

When the officer in charge instructed the OS to step clear from the rope, the OS hastily moved to another location, but fell on deck. The long messenger rope's slack likely caught his leg as the rope's exit continued dragging him towards the Panama Chock and then overboard.

Although the company's safety management system manual (SMS manual) established that tug lines must be let out in a controlled manner so that they do not fall onto a tug boat's deck or to avoid it becoming entangled with the propeller, the dynamic situation of tug separation was not anticipated. The officer in charge did not instruct the OS to keep a safe distance from the messenger rope's turn, such as tending the rope from the end, in case unexpected tension on the messenger rope occurred, which would have allowed for a safety margin in case of unexpected increase in the rope's exit speed.

What can we learn?

- Shipboard operations are extremely dynamic in nature. Mooring operations of all kinds, including those involving tugs, should be undertaken with utmost care. All personnel involved must fully understand the various possible scenarios that can occur, owing to their dynamic nature.
- Specific and clear instructions must be given beforehand, as a part of a pre-job brief, and a person in supervisory capacity should always assess risks and anticipate that circumstances and situations could change, so that mitigating measures can be communicated timely to members of his/her team.

Who may benefit?

Seafarers, shipowners and operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious casualty: An able seaman was crushed to death between two cargo containers

What happened?

A crew member (able seaman (AB)) lost his life by being crushed between two cargo containers when a fork-lift driver was conducting a manoeuvre to avoid the lifted container striking an adjacent stack of containers and in preparation for loading it onto a waiting trailer.

Why did it happen?

The AB was probably unaware of the fork-lift truck driver's intention to manoeuvre the container in preparation for loading it onto the waiting trailer. It is therefore unlikely that he anticipated the container would subsequently move towards him.

The fork-lift driver did not anticipate that the AB would move forward to remove the container's twistlocks before he had realigned the container and had given a signal for him to proceed.

The locally arranged signalling procedure was not effectively briefed and enforced, and was potentially unsafe in that it did not require the fork-lift driver to stop his vehicle when the twistlock operator was no longer in his field of vision. The routine nature of an unsighted crew member to remove the twistlock between containers, and the informality and lack of enforcement of the locally arranged signalling procedure, introduced complacent practices on board the ship. This lack of a safe system of work led to an ambiguous situation where two operators on the same task had different expectations of each other's actions.

The locally arranged signalling procedure did not feature in the ship's SMS, was not covered in the familiarization process and was neither briefed nor enforced, suggesting that an underlying cultural safety issue existed within the company.

The SMS risk assessment related to working was insufficient. It did not identify the specific hazard of a crew member being crushed by a moving container, or the need to address the risk of an unsighted crew member being positioned in the container's path.

What can we learn?

- Implementation of SMS procedures should be strictly fulfilled: some procedures were not implemented according to the ship's SMS, e.g. briefings were not carried out by the C/O to the twistlock operators and vehicle drivers.
- All aspects should be assessed in the risk assessment: there was no identification of specific hazard of a crew member being crushed by a moving vehicle or container; and no address of an unsighted crew member being positioned in the container's path.
- Communication between ship crew and embarked vehicle team and locally arranged signalling procedure should be maintained. The SMS should be reviewed to include safety needs of cargo operations, e.g. the "Cargo Operations Procedure" needed to take account of the other employers' (the embarked team of drivers) risk assessments. The company was required to provide proper familiarization to new personnel, including the embarked team of drivers, on their respective duties.
- It requires more precaution because the limitation of using closed-corner trailers necessitated crew members working in close proximity to suspended containers. Small gaps between containers stowed on the deck and the use of trailers with rear bumpers required fork-lift truck drivers to conduct manoeuvres that were difficult for assisting crew members to anticipate.

- It is unsafe to lift a container not fitted with fork pockets, using a forklift truck.

Who may benefit?

Seafarers, shipowners and operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious marine casualty: Fall from ladder while hold cleaning

What happened?

A bulk carrier was at anchor to carry out hold cleaning operations. The chief officer ordered two seamen to clean No.1 Cargo Hold and issued a permit to work for the activity in accordance with the ship's SMS.

The activity included the cleaning of the hold bulkhead corners by hand, which required the use of a portable aluminium ladder for working at height. One of the seamen ascended the ladder and carried out his task at a height of 4 metres above the cargo hold's tank top.

On completion of his task, the seaman, who was wearing a safety harness and lanyard, unclipped the lanyard. He then lost his balance, fell 2 metres onto the sloped side bulkhead, and then rolled a further 2 metres to the tank top.

The seaman was taken to the ship's hospital and later transferred to a hospital ashore, where he subsequently died of his injuries.

Why did it happen?

- There were several trip hazards where the seaman had been standing.
- The bulkhead against which the portable ladder was positioned was uneven.
- After unclipping the lanyard, there were no means to prevent the seaman from falling when he lost his balance.
- There was nothing in place to arrest the seaman's fall.
- The perception of the ship's crew was that personal care and vigilance were sufficient to avoid falling from the ladder once the lanyard had been unclipped.
- The activity was not supervised.
- The risk of falling in the cargo hold was neither specifically discussed in the ship's SMS nor identified in the ship's risk assessments.

What can we learn?

- An activity that poses a reasonable risk of falling a distance liable to cause personal injury should be properly planned and supervised.
- When identifying the safety controls required to reduce a risk of falling, the hierarchical principle of "avoid, prevent and minimize" should be applied.
- If a risk of falling cannot be avoided, measures are required to minimize the distance and consequences of the fall, such as the use of a fall arrestor and/or safety net or air bag.
- Seafarers should recognize the dangers of unclipping prematurely and not disconnect their safety devices until such time as they are in a safe position to do so.

Who may benefit?

Seafarers, shipowners and operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious casualty: Fatality due to scalding inside a boiler

What happened?

Upon the vessel's early morning arrival, a water leak was detected by an engineering watch officer coming from the main engine turbo charger drain. Suspecting a water leak in the boiler/economizer, the chief engineer ordered it be shut down so that it could be inspected for leaks and repaired later that morning during normal working hours. About five hours later the second engineer, along with a fitter, entered the boiler space from the bottom manhole door after they were satisfied with all safety precautions having been taken for man entry. They identified a leaky boiler tube and plugged it from the bottom. Next, their plan was to plug the same tube from the top of the boiler and then restart the boiler. While the second engineer was exiting the bottom manhole door with the fitter right behind him, the inserted boiler tube plug fell off along with a small broken section of the water tube causing hot water from the boiler water drum, steam and smoke to leak out upon the fitter, killing him instantly.

Why did it happen?

Lack of SMS boiler work risk assessment process. Failure of the engine-room team to identify all hazards involved for the intended procedure. Failure of the engine-room team to adequately and effectively check that the boiler was drained of water and depressurized. Likely fatigue of the second engineer.

What can we learn?

- The dangers of working around, with and on pressurized boiler systems.
- The value of having SMS procedures for working on pressurized systems such as boilers, as well as following those procedures.
- The dangers of relying on and making assumptions based on gauges.

- Risk assessment forms for this repair evolution were generic in nature and did not identify specific hazards associated with individual tasks.
- Boilers should only be depressurized when boiler water blow down commences to ensure all water from the drum is emptied overboard.
- Engineers should not solely rely on steam being emitted from the stack as the only indicator that a steam drum is empty. The boiler vent on top of the boiler should also be opened to check that a boiler is depressurized.

Who may benefit?

Seafarers, ship engineers, shipowners and operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious casualty: Two longshoreman were killed, one seriously injured

What happened?

While alongside a wharf, the vessel was loading a cargo of heavy stainless steel pipe bundles. Suddenly, and without warning, the vessel lurched, the suspended pipe load swung uncontrollably in the vessel's cargo hold, crushing three longshoreman between the suspended load and side wall; two died and one was seriously injured.

Why did it happen?

The underside of the vessel's fenders on the starboard shoreside amidships hull caught and hung up upon the top of the wharf's fenders. As the tide fell and the vessel's draft increased due to loading of the cargo, the vessel's list increased to a point where the ship's fenders suddenly released from the wharf causing the vessel to quickly and heavily roll. This caused the hoisted pipe bundles to swing in the cargo hold, striking the stevedores who were trapped between the swinging cargo hoist and the vessel's side wall.

What can we learn?

- The dangers of working in, on or around a vessel subject to ever-changing and dynamic forces.
- Hazards of working with suspended cargo in a confined cargo space.
- The value of critically evaluating a vessel's condition while alongside a dock, paying particular attention to identifying and eliminating snag hazards and tending mooring lines.
- The value of establishing cargo work plans to consider the possibility of sudden hull rolling and identifying worker refuge areas.

Who may benefit?

Seafarers, shipowners and operators, break bulk shoreside terminal managers, longshoreman and shoreside workers.

OCCUPATIONAL ACCIDENT (III 5)

Very serious marine casualty: Fatality in lift shaft

What happened?

A messman was found entrapped in the shaft of a provisions lift on board a bulk carrier. The lift was found off the guard rails with the lift motor still running. Following the recovery of the trapped messman from the lift shaft, it was confirmed he was deceased. How the messman came to be trapped in the lift shaft is unclear.

Why did it happen?

The lift doors were not fitted with limit switches to prevent operation of the lift when the doors were open, although they were shown in the original circuit diagram.

The lift controls only required a single touch to operate; they were not required to be constantly pressed.

Neither ship nor company staff had noticed that the door limit switches had been missing since the ship was built.

The provisions lift was not included in the ship's maintenance system and was not routinely inspected.

What can we learn?

- Shipboard operational maintenance routines should address the maintenance and inspection of lifts, taking into account the instructions of the manufacturer, if available.

The importance of delivering appropriate lift operation familiarization to a ship's staff.

Who may benefit?

Seafarers, shipowners and operators.

OCCUPATIONAL ACCIDENT (III 5)

Very serious marine casualty: Fatal strike by tow line

What happened?

A container ship was in the process of unberthing and a ship's mooring line was paid out from the ship's aft mooring deck to the waiting tug below. Once the line was secured, the tug pulled away causing the line to come under tension suddenly. The mooring line jumped out from the bitts on the aft mooring deck and hit a seafarer, who was standing nearby, in the chest, fatally injuring him.

Why did it happen?

- The seafarer was standing in the snap back zone.
- The seafarer was not adequately supervised.
- The officer in charge of the aft mooring deck was unfamiliar with using a ship's mooring rope as the towline rather than a tug's line.
- No risk assessment had been conducted to ensure adequate precautions were in place.
- There was ineffective communication between the tug and the ship.

What can we learn?

- The need to risk assess unfamiliar operations to establish suitable precautions.
- The importance of supervising junior staff.
- The need to employ the principles of good seamanship in paying out lines in a controlled manner.
- The need for clear and unambiguous communication between tug and deck crews when securing a tow line.

Who may benefit?

Seafarers, ship/tug owners and operators.

FATALITY (III 4)

Very serious marine casualty: Fall from platform in cargo hold

What happened?

A crew member was making repairs to the hand rails that surrounded the lowest of three intermediate platforms built into the cargo hold access ladder. The platform was designed as a landing to hold a single person while moving from one section of the cargo hold access ladder to the next. The ship was at sea and the cargo hatch covers were closed. The hand rails had been removed for repair and the crew member was about to refit them to the platform. The lower platform was five metres above the tank top. There was no eye witness to the accident, but it is likely that the crew member tripped or slipped from the platform and, as he was not wearing a safety harness, he fell to the tank top below. He died from multiple injuries.

Why did it happen?

1 The platform was cluttered with equipment that the crew member was using to effect the repairs and was not guarded by hand rails, making the platform a congested and dangerous place to work.

2 A single halogen light had been rigged about one metre above the platform. The light was another obstacle that the crew member had to work around.

3 Although shipboard procedures required the crew member to use a safety harness for the task, he was not wearing one at the time. Wearing a safety harness and connecting it to a secure point would have arrested his fall.

What can we learn?

1 Working at height without the protection of hand rails is a hazardous situation. It is important that seafarers follow industry best practice of using a safety harness when working at height.

2 It is important when working in dark spaces that sufficient lighting is used to illuminate the immediate and general working area without obstructing the workers.

Who may benefit?

Seafarers, shipowners, operators, providers of ship safety management systems.

FATALITY (III 4)

Very serious marine casualty: Fall while working over ship's side

What happened?

A crew member fell overboard when the rope of the Bosun's chair that he was sitting on parted. The man had been painting the amidships draught marks of a 41,000 GT bulk carrier while it was anchored off a port. He was wearing neither a lifejacket nor a flotation aid, and the lifeline attached to him was not properly tethered to the ship.

The accident occurred during daylight hours in the morning in good weather conditions. Crew members on deck threw a lifebuoy towards the man in the water but he could not reach it and quickly sank. The crew then launched the ship's rescue boat but were unable to start its engine. The search for the missing man was conducted by boats and a helicopter from the port. Despite searching for the rest of the day, his body was not recovered.

The task to paint the draught marks had been undertaken after the master had issued a permit to work over the side. The missing crew member was the only person working over the side while the other crew were on the ship's deck. The crew member supervising the task had agreed with the seafarer not to wear a lifejacket. The rope parted while the crew were heaving it up after the painting task had been completed.

Why did it happen?

1 The rope holding the Bosun's chair was in poor condition – the main reason for its failure. Further, the crew were heaving the rope to recover the man sitting on the Bosun's chair instead of using a safer method, such as a rope ladder for the man to climb up to the deck.

2 Although a permit to work over the side had been issued, basic precautions were

not in place. These include using a personal flotation aid, effective fall prevention equipment and proper supervision. The person supervising on deck had agreed to dispense with the available lifejacket as it was inconvenient to work while wearing it. The lifeline was not properly secured to the ship, and other equipment, such as the rope that parted, had not been properly inspected to ensure it was fit for purpose.

What can we learn?

- 1 Safely working over the side of a ship relies on an effective permit to work that ensures suitable precautions are in place, including the wearing of an appropriate flotation aid and proper use of fall prevention equipment.
- 2 Work over the side must be properly supervised to ensure all measures identified in the permit to work are followed.
- 3 Preventing a person falling overboard should always be a primary objective.
- 4 Wearing a flotation aid significantly improves the chances of a person's survival and recovery, and its design should be appropriate for the work being undertaken.
- 5 It is also essential to have effective man overboard recovery measures in place, including properly trained crew and maintained equipment such as rescue boats.

Who may benefit?

Seafarers, shipowners, ship operators.

FATALITY (III 4)

Very serious marine casualty: Crew member struck by waves on deck

What happened?

A crew member was seriously injured on the fore deck of a 7,000 GT oil tanker when he was struck by waves while going to the forecabin to close a weathertight door. The accident occurred about mid-afternoon in bad weather (gale force winds and 5-metre waves). Seas were being shipped on deck and the crew member was alone.

The officer of the watch had instructed the crew member to close the weathertight door but had not informed the master or anyone else. The crew member did not inform anyone else and followed the officer's instruction. After the accident, the officer of the watch announced on the public address system that the injured man needed to be rescued but did not specifically inform the master. Crew members proceeded forward and rescued the injured man before the ship had been turned around and away from the weather.

The injured man was then provided first aid. The master diverted the ship to the nearest port, where it arrived that evening. The injured man was taken to a hospital ashore but was later declared deceased.

Why did it happen?

- 1 The weathertight door opened in heavy weather because it had not been properly secured for sea or checked before the onset of bad weather.

2 The crew member who died was on the fore deck with the ship heading into heavy weather. The officer of the watch did not consult or advise the master of his intentions and did not take sufficient account of the risk of sending a man forward in heavy weather without taking any precautions.

3 The crew member also did not take sufficient account of the risk of going forward in the prevailing conditions or challenge the instructions of the officer of the watch.

What can we learn?

1 It is dangerous to go on a ship's deck in heavy weather. If going on deck is considered critical for the ship's safety, the master needs to risk assess the operation and take all precautions to minimize the risks.

2 Turning the ship away from heavy weather to reduce rolling/pitching and the risk of shipping seas is an essential precaution to take before anyone goes on deck.

3 It is essential to properly secure a ship for sea, including closing all weather/watertight doors and other openings on deck.

4 Monitoring forecast weather at sea is essential so that necessary precautions, including checking that weather/watertight openings are securely closed, are taken before encountering heavy weather.

Who may benefit?

Seafarers, shipowners, ship operators.

FATALITY (III 4)

Very serious marine casualty: Crew members struck by wave on deck

What happened?

The Bosun of a 6,000 GT bulk carrier was swept overboard by a wave, and the Chief Mate and deck cadet were seriously injured, while they were returning from the ship's forecandle in heavy weather. The Bosun's body was recovered from the sea by search and rescue authorities about two hours later – he had drowned.

The master had anchored the ship the night before the accident after encountering winds of 50 to 60 knots. The ship's main engine was left running at minimum rpm. After breakfast the next day, the master instructed the three crew members to go to the forecandle and check the anchor cable. The weather was still poor with the wind more than 50 knots. The three men donned lifejackets and other personal protective equipment and went to the forecandle. When they reported the anchor cable had parted, the master instructed them to return from the forecandle. As the men were returning aft along the port side holding a lifeline near No.2 Cargo Hold, they were struck by a large wave that washed across the deck from the starboard side as the ship rolled to port. The Chief Mate, who was leading the group, reported to the Master that the Bosun, the last in the group, was missing and that he and the cadet had been injured.

The Master raised the alarm and instructed other crew to rescue the injured men and search on deck for the missing Bosun. The injured men were taken to the ship's hospital but the Bosun remained missing. The Master then requested help from shore authorities, who recovered the Bosun's body from the sea. The injured crew were taken to a hospital ashore

by helicopter.

Why did it happen?

- 1 The ship was anchored in heavy weather instead of being hove to or seeking shelter from the storm.
- 2 The crew members were sent on deck in heavy weather.
- 3 Neither the Master nor the Chief Mate and other crew who went on deck adequately considered the high risk of going on deck in heavy weather.

What can we learn?

- 1 Anchoring a ship in heavy weather is hazardous and its anchoring equipment is not designed to be used in heavy weather.
- 2 Good seamanship requires a Master encountering heavy weather at sea to consider all safe options, one of which must include the ship being hove to until the weather moderates.
- 3 It is dangerous to go on a ship's deck in heavy weather. If going on deck is considered critical for the ship's safety, the Master needs to perform heavy weather risk assessment in advance and take all necessary precautions.

Who may benefit?

Seafarers, shipowners, ship operators.

FATALITY (III 4)

Very serious marine casualty: Stevedore ashore struck by mooring rope

What happened?

An 8,500 GT general cargo ship was being moored alongside a wharf. A stevedore was standing near a slack mooring line, which was suddenly tensioned, knocking him into the water. The stevedore was not involved with the ship's mooring operations and had been on the wharf to attend to shore cargo cranes.

The accident occurred in the afternoon. About 15 minutes after the accident, the stevedore was sighted floating face down in the water. He was recovered from the water and given cardiopulmonary resuscitation but showed no signs of life. An ambulance then took his body to a hospital.

No one on the ship or on the wharf had noticed the stevedore move into a hazardous position near the mooring line that was heaved up. The ship's officer signalled the man operating the winch on the forecastle to heave in the mooring line. In order to signal him, the officer had moved to a position from where he could no longer see the mooring line on the wharf.

Why did it happen?

- 1 The stevedore moved into a hazardous area, where mooring operations were still underway. The ship's crew on deck could not see him or the mooring line on the wharf from their positions, and no one on the bridge noticed him.

2 The shore mooring linesmen did not prevent the stevedore from entering the hazardous area where they were still conducting mooring operations. The mooring gang company's safety management system did not have adequate procedures to prevent unauthorized entry to prohibited areas. There were neither warning signs for such areas nor other physical measures to prevent entry to them. The safety oversight of the company managing the wharf (with respect to supervision of the mooring gang company) was also inadequate.

What can we learn?

1 The person supervising or controlling the tension on the mooring line should always have the mooring line in sight to avoid accidents.

2 Effective communication between the bridge and ship mooring stations can ensure safer mooring operations, including active monitoring of the operations.

3 Only authorized persons should be permitted in areas where mooring operations are taking place both on board ships and on the wharf.

Who may benefit?

Seafarers, shipowners, ship operators, port and terminal operators.

FATALITY (III 4)

Very serious marine casualty: Entry of an enclosed space

What happened?

A 35,000 GT bulk carrier with steaming coal in bulk arrived at a port and was moored.

Able Seaman (AB)1 and Ordinary Seaman (OS)2 were instructed by the Bosun to access Cargo Hold No.3 to take a cargo sample. The cargo hold hatch covers and access hatch cover were closed. AB1 opened the access hatch cover and entered the cargo hold unaccompanied and without taking any safety precautions.

OS2 saw AB1 fall from the access ladder and asked the Bosun to come. The Bosun arrived and accessed the cargo hold to help AB1, who was lying unconscious. AB2 then arrived and entered the cargo hold, followed by OS1, all three entering the hold without taking any safety precautions or considering the possible danger. They all then collapsed.

The chief officer heard about the incident and went to the area, taking with him a breathing apparatus set. An ambulance was called via the agent and arrived within 15 minutes. The Bosun died as a result of the casualty.

Why did it happen?

1 AB1 was instructed by the Bosun to enter the cargo hold despite the access hatch being marked "NO UNAUTHORIZED ENTRY INTO CARGO HOLDS" and no crew members having been ordered by an officer to do so.

2 None of the required precautions were taken to provide safe access when AB1 was instructed to enter the cargo hold.

3 The Bosun, AB2 and OS1 all entered the cargo hold unaccompanied to provide help

without first taking any safety precautions.

What can we learn?

- 1 Access to enclosed spaces without required safety measures in place occurs frequently and leads to casualties.
- 2 Self-contained breathing apparatus sets should be placed close to the entrances of enclosed spaces during entry, and be readily available for use in an emergency.
- 3 The need for authorized entry of enclosed spaces, required precautionary safety measures and relevant training should be stipulated at safety meetings and during newcomer familiarization.
- 4 Effective enclosed space entry training and drills should take into account the instinctive reaction of seafarers to provide assistance and highlight that doing so without appropriate safety equipment is hazardous and can result in additional casualties.

Who may benefit?

Seafarers, shipowners, ship managers.

FATALITY (III 4)

Very serious marine casualty: Entry of an enclosed space

What happened?

The crew of a 9,000 GT bulk carrier with a cargo of sawn timber was practising a weekly emergency drill. When the chief officer did not appear at his muster station, a search was conducted.

During the search, two junior ratings discovered that the access hatch cover to Cargo Hold No.3 was open and, looking inside, noticed the chief officer lying at the base of the stairway on platform No.2.

The chief engineer then entered the enclosed space without taking adequate safety precautions, and subsequently collapsed on top of the chief officer on platform No.2.

On hearing calls for help from the chief engineer, the second officer then also entered the enclosed space without taking adequate safety precautions, and collapsed on top of the chief engineer.

Four crew members wearing breathing apparatus sets entered the space to retrieve the three officers, taking with them equipment to assist the injured officers with their breathing.

The three officers were lifted out of the cargo hold and given CPR. The second officer was taken to a local hospital. However, the chief officer and chief engineer died.

Why did it happen?

- 1 The existing shipboard operational procedures did not take account of the carriage of timber cargoes and the danger posed by oxygen depletion.
- 2 There were no warning notices at the point of entry to the cargo hold, on either the outside or inside of the access hatch cover.

3 An enclosed space entry procedure had not been detailed as a key shipboard operation in the Safety Management System (SMS).

4 The human instinct of wanting to save a colleague resulted in the chief engineer and second officer entering an unsafe space without suitable precautions for their own individual safety.

What can we learn?

1 There are inherent dangers associated with entry of enclosed spaces, particularly cargo holds, no matter what type of cargo they may contain, including those posed by oxygen depletion from the timber cargo.

2 There is a need to ensure that all persons who are required to enter an enclosed space positively identify the atmospheric condition against parameters, which should be stated in the SMS together with procedures for safe entry.

3 Effective enclosed space entry training and drills should take into account the instinctive reaction of seafarers to provide assistance and highlight that doing so without appropriate safety equipment is hazardous and can result in additional casualties.

Who may benefit?

Seafarers, shipowners, ship managers.

FATALITY (III 4)

Very serious marine casualty: Fall from a vertical ladder in a cargo oil tank

What happened?

A 30,000 GT chemical tanker anchored in an offshore anchorage with all cargo oil tanks (COTs) and the starboard slop tank having been cleaned and gas-freed for inspection of the condition of tank coatings.

The shipowner's technical consultant (the superintendent) and two paint supervisors from the cargo tank coating manufacturer boarded the vessel in the morning. The superintendent, who was in attendance to carry out an Environmental Audit, also intended to inspect the cargo oil tanks for tank coating condition and any deep suction well pitting.

After all preparation work was completed, which included a risk assessment and issue of enclosed space entry permits, the tank inspection commenced.

During the day and prior to the accident, the superintendent entered three cargo oil tanks and spent a total of 73 minutes staying inside the tanks. In the afternoon, the chief officer entered 4S cargo oil tank followed by the superintendent. Firstly, the chief officer climbed down the vertical ladder and reached the landing platform. He stayed on the platform to wait for the superintendent. The superintendent then entered the tank and climbed down the vertical ladder. Suddenly, he fell from the vertical ladder to the bottom of the cargo oil tanks.

The chief officer immediately informed the Bosun, who was the responsible person at the entrance to the cargo oil tanks, by radio. The Bosun immediately relayed the message to the duty officer on the bridge and the ship's Master. The superintendent was rescued and sent to hospital ashore for treatment. However, the superintendent was declared deceased by a local

doctor.

Why did it happen?

1 At the time of the accident, the ambient temperatures on deck and inside the cargo oil tanks were about 33°C and 37°C respectively. The superintendent might have suffered from heat exhaustion that caused him to lose his grasp of the vertical ladder while he was entering 4S cargo oil tank in the afternoon under high ambient temperature.

2 The vertical ladder had no guard rings, which could have prevented him from falling sideways after he lost his grasp of the ladder.

What can we learn?

1 It is necessary to take extra precautions and to use fall arrestors as far as practicable to avoid falling when climbing on a vertical ladder that is not fitted with guard rings.

2 Account should be taken of the impact of heat on the human body during prolonged periods of work in a hot climate.

Who may benefit?

Seafarers, shipowners, ship managers.

FATALITY (III 3)

Very serious marine casualty: tug master struck by a falling stores container

What happened?

While discharging a routine parcel of crude oil alongside an oil terminal, a 58,000 GT tanker was simultaneously using its crane to receive stores from a barge (with an assist tug), which was secured on the tanker's seaside. The barge had two deckhands and the tug master in attendance. The storing operation was being conducted by six members of the tanker's crew, who were being supervised by the off-duty third mate. An additional officer had also been called to assist. The Bosun was operating the crane while the remaining crew/officer were engaged in unloading the stores and transferring them to the galley.

The procedure for the operation was as follows:

- The vessel's crane hook was lowered to the barge.
- The crane hook was fitted with a four-legged chain sling.
- Two web slings (left in place under the container when it had been loaded onto the barge) were attached to the chain sling arrangement.
- A deckhand on the barge signalled to the Bosun by hand that the lift was ready, and the Bosun then operated the crane.
- As the weight came on the chain slings, the barge deckhands held the slings as far out toward the sides of the container as possible.
- The container was then lifted from the deck of the barge.

- When the container was above shoulder height, the two deckhands moved aft along the barge to positions clear of the area under the lift.

After transferring the first container to the tanker, the barge deckhands arranged for a second container to be transferred. They then moved away, leaving the tug master on the main deck of the barge to look out for the returning first container. On board the tanker, the second container was being emptied while the nearly empty first container was prepared to be transferred back to the barge with some frozen fish to be returned.

The assisting officer placed the web slings under the container's open forklift tyne slots, hooked up the ship's crane and, after some adjustment to make the container and slings stable, directed the lift towards the barge. Once the container cleared the ship's rail, the officer moved his attention away from the site. As the container was being lowered, it rotated out of the slings and fell onto the barge below, striking the tug master who was standing under it.

Why did it happen?

- The stores container was incorrectly rigged on board the tanker. While the barge crew knew where and how to place the slings, they assumed that the ship's crew would likewise return the container. However, the web slings were passed through the open forklift tyne slots rather than the closed tyne holes. As a result, the container was easily unbalanced and toppled free from its slings as it was being lowered to the barge.
- The tanker's crew did not warn the crew of the barge of the returning container and thus, the barge crew did not pay attention to the operation. As a result, they were not aware that the container was being returned.
- There was lack of supervision during the storing operation despite two officers being present. As a result, the crane operator was, in the absence of any other clear direction, the person in charge.
- The ship's and the barge's crews viewed the storing operation as a routine task and had developed a false sense of security about the dangers associated with loading and unloading stores.

What can we learn?

- Relevant and appropriate job hazard analysis, risk assessment and tool box talks, even for tasks that seem routine, can increase awareness of the risks involved.
- Effective communication between the involved parties can help to ensure that everyone has the same mental model of a hazardous situation.
- When in doubt, ship's officers and crew should seek clarification from senior officers and/or shore contractors, especially when handling non-ship's equipment.
- Personnel involved in cargo operations should always stand clear of suspended loads.

Who may benefit?

Seafarers, shipowners, ship managers.

FATALITY (III 3)

Very serious marine casualty: able bodied seaman struck by debris from exploding windlass motor

What happened?

While waiting for its berth to load a cargo of coal, a 39,000 GT bulk carrier anchored in a designated anchoring position as provided by the port authority. The next day the port authority instructed the vessel to shift its anchor position further south, and the vessel then re-anchored and brought up to seven shackles on deck on its port anchor. The nature of the sea-bed at a depth of 53 metres was a mixture of fine sand and shells.

Two days later, while still at anchor the wind speed increased to Force 6. Sea swell was about 2-3 metres. The chief mate was sent to check on the anchor cable. The officer reported dust coming out of the windlass, there was excessive weight on the anchor cable and the bow securing pin was bent.

The bow securing pin from the starboard anchor was used to replace the one on the port anchor cable, which also got bent shortly afterwards. A stainless steel rod was then fabricated on board to replace the newly bent pin.

At night time the duty officer, who was asked to check on the condition of the cable, reported that the distance from the nearest ship was reducing and confirmed that own vessel was dragging anchor. Stations were called and main engines were prepared. The hydraulic power pack for the windlass was switched on. The chief officer, along with six crew at the forecabin, prepared to heave the anchor. As the cable was up and down, the master used the engines (half ahead) to keep the vessel away from dragging onto the nearby ship. The anchor cable lay astern as the vessel moved ahead and dredged on its anchor. Subsequently, moderate weight came on the cable and the cable came back to up and down. Heaving of the anchor resumed. The master then notified the port authority of his intention to shift the anchor position.

Subsequently, the lay of the anchor cable changed from up and down to ahead medium stay to abeam short stay to astern. At some point when the cable was leading astern the anchor could not be heaved up any further. As the attempt to heave the anchor continued, the crew saw sparks flying out of the port windlass. The windlass operator, an able seaman, applied the brake on the anchor cable. Soon after, the windlass motor exploded and flying debris from the explosion hit the windlass operator on his neck and jaw.

The power to the windlass was stopped by the other crew and the brake was re-applied. On-site first aid and pressure to the wound of the injured operator were applied by the crew. The master requested medical assistance. An hour later the injured operator stopped responding and was declared deceased by paramedics an hour thereafter.

The port anchor was subsequently heaved up using the motor from the starboard windlass. The anchor was noted to be fouled with an abandoned anchor chain on the sea-bed.

Why did it happen?

- Operation of the port windlass hydraulic motor in the reverse direction would have resulted in severe rise of hydraulic pressure inside the motor due to the positive displacement pumping action, causing the motor to explode.

- The loading capacity of the windlass was exceeded due to dragging anchor, shock loading due to heavy rolling and pitching of the vessel in severe conditions, frictional force due to chain rubbing against the hull and fouling of the anchor by an abandoned anchor chain.
- The master had not fully assessed the future weather conditions at the anchorage to prepare for heaving the anchor before the weather worsened.
- The windlass manufacturer had not provided any safety guards around the windlass on existing vessels to protect the crew. These however had been provided on new vessels.

What can we learn?

- Appropriate training and familiarization on board is necessary to ensure the correct handling procedure for the anchor windlass and vessel, with special emphasis on circumstances such as anchor dragging, adverse weather conditions, anchor fouling, etc. which may place excessive load on the windlass equipment.
- Severe weather conditions can place excessive loads on the windlass motor and ship's crew should take appropriate precautions in a timely manner to avoid such loads.
- Physical guards may protect crew from potential explosion of a windlass hydraulic motor.

Who may benefit?

Seafarers, shipowners, ship managers.

FATALITY (III 3)

Very serious marine casualty: master and oiler struck by deck cargo in bad weather

What happened?

While on passage in bad weather, the master of a 23,000 GT bulk carrier summoned crew members to the main deck in order to secure some loosened deck cargo lashings. A high wave struck the vessel, causing further shifting of the deck cargo and the breaking up of cargo lashings. It is believed that the shifting cargo hit the master and an oiler, although nobody witnessed the accident happen at the material time.

Nearby ships were called for help. As a result, a naval ship arrived to provide assistance to the vessel. A helicopter was arranged to transfer the injured oiler, who was in a stable condition, to the nearest hospital ashore, but the master was declared deceased.

Why did it happen?

- The rolling and pitching of the vessel causing the cargo to shift.
- The master and crew accepted working in an unsafe environment.
- There was a lack of an effective risk assessment with regard to the hazards involved in securing the loosened deck cargo lashings.

- The master was overconfident in securing the deck cargo lashings without following company safety procedures, and in carrying out the work himself instead of arranging and supervising other crew members to do so.

What can we learn?

- Risk assessment is essential and helpful in order to assess and improve ship operations with respect to the reduction of fatalities and hazards to the crew, the vessel, and the environment.
- The identification, assessment, and management of risk must be dealt with in identifying the elements to be assessed, the reason for the assessment, details of the activities related to them, and to establish adequate controls and procedures. In this accident, nobody, not even the master, was designated for supervision and there was no effective communication between the working crew. A proper risk assessment of working in bad weather conditions must be conducted and discussed before commencing operations on the weather deck, such as securing deck cargo lashings, mooring, or electrical jobs.
- A proper risk assessment must be conducted before any work on deck when bad weather is forecasted. The results of the risk assessment should be discussed with the crew and all controls to mitigate the risks should be in place before work begins.
- Regular safety meetings are important opportunities for all crew members to evaluate and discuss their safety sense and improve their knowledge and approach to any shipboard operation.

Who may benefit?

Seafarers, shipowners, ship managers.

FATALITY (III 3)

Very serious marine casualty: fatality following entry of an enclosed space

What happened?

A 24,000 GT general cargo ship was discharging a bulk coal cargo. When the cargo discharge from one of the cargo holds had been completed, the second deck officer (the 2/O) decided to check the structural integrity of the cargo hold and entered the space without informing others. When an able seaman (the AB) failed to receive feedback to his portable radio call to the 2/O, he decided to look for him. When the AB noticed that the cargo hold access hatch cover was open for no apparent reason, he entered the space through the hatch access. Before the AB could call the chief officer about his finding the 2/O, who had lost consciousness inside the space, he collapsed with the 2/O.

When the missing 2/O and AB came to the mind of the chief officer and they failed to respond to his portable radio call, the chief officer instructed a sailor to look for them. The sailor eventually managed to discover from outside the cargo hold access hatch that the AB was lying inside the space, and he decided to rescue him by entering the space. Once inside the space, he felt dizzy but managed to call the chief officer before fainting. When the chief officer went to the cargo hold access hatch and realized the situation, he returned to the

accommodation, triggered the general alarm to summon a rescue team and notified the port authority, requesting help.

The rescue team successfully brought out the three crew members from inside the space. They were then taken to hospital ashore. The 2/O was later certified deceased. The sailor and the AB recovered on the same day.

Why did it happen?

- Safety procedures for entry of an enclosed space (Safety Management Manual, SOLAS regulation III/19 and resolution A.1050(27)) were not followed.
- There was a communication breakdown among working crew on board. The 2/O failed to use a safe alternative access to the cargo hold, which was a ladder used by stevedores for cleaning the cargo hold throughout that day.
- The victims did not use personal protective equipment suitable for enclosed space entry, and they did not have permission to enter the space.

What can we learn?

- Numerous enclosed space accidents are the result of non-compliance with safety procedures for entering an enclosed space.
- Never enter an enclosed space unless safety procedures for entering an enclosed space are in place, including arrangements for dealing with emergencies and rescue.
- No attempt should be made to rescue someone unless safety procedures for entering an enclosed space are followed.
- The atmosphere in an enclosed space can quickly become hazardous.
- Within an enclosed space, if a person perceives changes to their well-being, or suspects an emerging serious and imminent risk, the space should be vacated immediately.
- Enclosed space entry and rescue drills must be conducted and participated in as required by SOLAS regulation III/19.

Who may benefit?

Seafarers, shipowners, ship managers.

FATALITY (III 2)

Very Serious Marine Casualty: Man overboard resulting in a fatality

What happened?

A large containership was at sea, rolling gently to about five degrees. The bosun decided (without being instructed, or requesting permission) to use the ship's gantry crane to shift some steel pipes from the deck to the engine-room. He climbed into the crane [trolley or basket] to remove the safety pins that stopped the trolley from moving while the ship was at sea. As soon as the bosun removed the pins, the trolley began to move in an uncontrolled

manner towards the ship's side with the bosun in it. The trolley hit the end stops on the gantry, but they failed to stop the trolley, which, along with the bosun, fell into the sea. Man overboard procedures were initiated and search and rescue operations were launched, but the bosun was not recovered and was presumed dead.

Why did it happen?

- The bosun used the crane without permission of an officer and against the advice of the Able-Seaman who was assisting him.
The crane was being used at five degrees, its design angle of heel limit.
- The safety mechanisms, which should have prevented the crane trolley from leaving the gantry, catastrophically failed.

What can we learn?

- Lifting appliances should not be used without the appropriate permissions required in the ship's safety management system.
- All lifting operations should be subject to planning, risk assessment and supervision.
- Lifting operations when a ship is moving in a seaway should be approached and planned/risk assessed with **extreme caution**.

Who may benefit?

Shipowners, operators and crews.

FATALITY (III 2)

Very Serious Marine Casualty: Fall from height in a ballast water tank resulting in a fatality

What happened?

An officer, safety officer and crew member were proceeding to exit a ballast water tank. They had just completed an air quality inspection of the tank prior to its undergoing maintenance. The crew member, who was to be the last person to exit the tank, was about one metre from the exit when he lost his grip and fell approximately 10 metres. Although the crew member was treated in the tank, he succumbed to his injuries two hours later. It took four hours to cut an escape hatch by which the crew member could be recovered from the tank.

Why did it happen?

- The design of the tank's access prevented the immediate removal of the injured crew member from the inside of the tank.
- Fall arrestors, lanyards and safety harnesses were not being used, nor were there any brackets or strong points for securing safety equipment.
- The crew member was carrying a gas detector (which he wore around his neck and which lay on his stomach) and a rope while climbing the ladder. As he tried to untangle the gas detector, he lost his grip and fell.

What can we learn?

1. Hazard and rescue assessments should be carried out prior to entering a confined space.
2. Safety procedures should be established and followed for use of ladders. These should include keeping hands free at all times and using appropriate means for hoisting and lowering of tools and equipment.

3. Tank entrance design should accommodate the possibility of evacuating an injured person.
4. The importance of proper safety harness and its use.

Who may benefit?

Shipowners, operators and crews.

FATALITY (III 2)

Very Serious Marine Casualty: Crew member hit by swinging crane hook resulting in a fatality

What happened?

A stevedore was using ship's cargo crane and grab to load cargo onto the ship. Upon completion of his daily shift, he left the crane with the grab connected and the boom in the horizontal position, and then disembarked. Later, the chief officer arranged for two crew members to disconnect the grab from the crane to place it in its designated stowage position on the starboard side. While one crew member was on the deck disconnecting the grab from the crane hook, the other crew member was operating the crane from the crane's cabin to facilitate the grab disconnection. During the course of the work, the weather deteriorated and the ship encountered a heavy swell, causing it to roll and pitch. While the hook was being hoisted by the crane, it swung and crashed into the lower half of the operator's cabin. The crew member inside the operator's cabin was badly injured and taken to hospital, where he was declared dead upon arrival.

Why did it happen?

- No risk assessment was conducted before the job was carried out. The crew were not familiar with the crane operating procedures.
- Despite receiving a forecast of deteriorating weather, the ship's crew proceeded with the crane operation, ignoring the hazard.
- No precautions were taken to avoid the hook swinging as a result of the ship rolling and pitching in the heavy swell.
- The crane operator's cabin structure failed to provide sufficient protection to the operator inside.
- There were no specific instructions in the safety management system other than that the chief officer was to supervise the work on deck.

What can we learn?

- The importance of the risk assessment prior to work commencing.
- All crane operations should be closely monitored. Crane operations should not be allowed during heavy weather.
- Crane operations should be covered in the ship's safety management system.
- Internal audits of all company ships should be carried out to ensure full compliance with the safety management system on the safe operation of cranes.
- Crane operating crew need to be fully briefed and familiar with operating limitations.
- The structure of a crane operator's cabin should be sufficiently reinforced or protected.

Who may benefit?

Ship builders, owners, operators, and crews.

FATALITY (III 2)

Very Serious Marine Casualty: Stevedore struck by falling crane cabin panel resulting in a fatality

What happened?

Two gangs of stevedores boarded the ship to load granite blocks. The ship's cranes, operated by the stevedores, were used for lifting the cargo. Stevedores were also deployed to stow the cargo and unhook the cargo sling. While cargo loading was in progress, a crane cabin front view panel detached from its hinges and fell onto a stevedore, who was working in a cargo hold. The ship's emergency team was mustered to render immediate medical aid, and an ambulance was called. The victim was fatally injured and another stevedore in proximity received minor injuries.

Why did it happen?

- The hinges of the panel frame had badly corroded due to a lack of maintenance.
- A telescopic stopper, which had been provided to keep the panel in place at varied open positions, had been removed by the stevedore operating the crane. The stopper was substituted with a wooden plank to create a wider opening of the panel that increased ventilation and allowed a clear view of the cargo hold.
- The stevedoring company did not provide appropriate personal protective equipment for its employees for working in potentially hazardous areas.
- The ship's staff did not ensure that all equipment was in good working order and free of any defects.
- The ship's staff did not provide necessary information and instructions to stevedores about usage of ship's equipment prior to its use.

What can we learn?

- The ship's staff should provide safe ship gear and equipment to stevedores, ensuring that it is in good working order and free of any defects.
- The ship's staff should also provide necessary information and instructions to everyone working on board to ensure their safety while engaged in cargo handling operations. The safe working practices, the potential risks and the necessary safety measures while engaged in cargo handling operations must be provided.
- Due to the intense nature of the work of the crane operator, special care should be taken to ensure adequate ventilation of crane cabins so that the crane operator is able to carry out the work accurately and efficiently in optimum environmental conditions.
- Before putting any cargo gear in use, visual checks should be carried out to determine its serviceability. The manufacturer's pre-start and operation checklist for cargo cranes should be completed prior to cargo operations.
- Risk assessments must be reviewed and explained to all personnel involved in cargo operations. Where appropriate, when an additional risk assessment is

necessary, this must be undertaken, documented and retained on record. Assessment must be sufficient and suitable.

- The stevedoring company should provide adequate personal protective clothing, such as safety helmet, safety shoes and safety harness, to its employees. Stevedores should undergo periodic training of safe working practices of various cargo operations.
- The stevedore team supervisor should meet with the ship's officer of the watch and obtain the necessary information and instructions to ensure the safety of his stevedores while they work on board the ship.
- The stevedores deployed on board ship must not tamper with cargo crane fittings or remove components. Instead, any malfunction or defects of the ship's cranes or other equipment in use by stevedores should be reported directly to the ship's crew.

Who may benefit?

Seafarers, shipowners, ship managers and stevedoring companies.

FATALITY (III 1)

Very Serious Marine Casualty: Loss of life on board a fishing vessel

What happened?

A fishing vessel was preparing to shoot two nets over the stern when one of the nets became snagged. One of the crew members, wearing a hard hat and a waistcoat style buoyancy aid without a collar, climbed over the rail, walked across the trawl deck and freed the net. As the crew member crossed back over the trawl deck, he stumbled and fell on top of the other net. At that moment the vessel surged on the swell and the net ran out over the stern ramp, carrying the crew member overboard with it. He ended up in the water no longer wearing his hard hat and unconscious. The crew member was retrieved but, due to the vessel's movement in the swell, the crew was unable to bring him back on board using the boarding ladder and the scramble net. A liferaft was deployed and the crew member was pulled into the raft and given cardiopulmonary resuscitation. The crew member was later winched aboard a rescue helicopter and brought ashore, where he was pronounced dead.

Why did it happen?

The crew member was on the trawl deck when the nets were being shot, which was contrary to onboard practice.

The crew member's hard hat had been fitted with a chin strap, but it is not known if the hat had been properly secured with the strap.

Whether conscious or not, the personal flotation device worn by the crew member was of a design that did not keep his head out of the water.

There was no effective arrangement in place to recover a person from the water.

What can we learn?

- The importance of complying at all times with onboard policies and procedures.
- The use of appropriate personal protective equipment, including safety harnesses, by crew members.
- Having in place a recovery device suitable for retrieving an unconscious person from the water.

- The importance of carrying out practice drills for man overboard recovery.

Who may benefit?

Fishing vessel owners, operators and crews.

FATALITY (III 1)

Very Serious Marine Casualty: Loss of two lives and two serious injuries during a lifeboat exercise

What happened?

A lifeboat fitted with an on-load release mechanism was lowered into the water with four crew members on board. Its motor and spraying system was then tested without the davit falls being disconnected. After the testing, the lifeboat was hoisted, stopped at the one metre above the water for the crew members to check the hooks, and then hoisted again. Because of the lifeboat's oscillations, the hoisting was stopped with the lifeboat around two metres from the stowage deck platform. The davit fall connected to the forward hook then released, causing the lifeboat to be temporarily supported only by the aft hook. The aft davit fall then released. The lifeboat fell into the water from a height of approximately 30 metres. Two crew members died and two others suffered serious injuries.

Why did it happen?

The forward davit fall lifting ring was able to pass between the forward hook and retainer because there was a gap between the hook and the retainer. The crew member in charge of maintenance of the on-load release mechanism did not know the required clearance between the hook and the retainer. This was partly because the on-load release mechanism operating and maintenance manual did not mention how to adjust the gap, and partly because the manufacturer did not give training to the crew members at the time of its installation on board.

The company, owner and crew members did not ask the manufacturer for the technical manual, which would have provided the required clearance and means for adjusting the gap between the hook and the retainer.

The company and owner did not ensure that an inspection of the lifeboats, including the on-load release mechanism, by the crew member in charge of the maintenance was conducted at appropriate intervals and that a non-conformity report was submitted to the company.

There was no safety barrier in the event of an inadvertent release of the on-load release hook.

What can we learn?

- Crews need to be aware of the risks associated with crewmembers riding in lifeboats as they are lowered and hoisted during drills. Further guidelines on safety during abandon ships drills using lifeboat can be obtained in the IMO document MSC.1/Circ.1206/Rev.1.
- The company's SMS should consider the need for the use of a safety defence such as fall preventer device to address an inadvertent release of the on-load release mechanism during abandon ship drills.

- The operating and maintenance manual of a lifeboat needs to describe in detail the on-load release mechanism and means for adjusting the gap between the hook and the retainer.
- Special care needs to be taken by crew members to ensure the on-load release hooks are properly connected to the lifting rings and the operating mechanism is locked in place before starting to launch or hoist a lifeboat.
- It is important that a competent crew member is put in charge of maintenance conducts an inspection of the lifeboats, including the on-load release mechanism at regular intervals laid down in the SOLAS convention.
- Shipowners should ensure that the guidance in MSC.1/Circ.1206/Rev.1 is followed, including having on board the manufacturer's manuals and instructions for the equipment fitted.

Who may benefit?

Shipowners, operators and crews, and lifeboat manufacturers.

FATALITY (III 1)

Very Serious Marine Casualty: Fatal accident of a crew member during an unmooring operation

What happened?

A deckhand was working on board a river ferry to release lines that were securing the vessel overnight to a mooring buoy. He was dragged violently against the vessel's bulwark and was carried overboard by a mooring rope which had become entangled in the vessel's propeller and was being wound in. He suffered severe facial injuries and was almost certainly unconscious when he entered the water. He subsequently drowned although his lifejacket brought him to the surface and he was recovered by his colleagues to a workboat within minutes.

Why did it happen?

The mooring rope could have become trapped between the vessel and the buoy because: the vessel came ahead further and faster than usual; the rope was being recovered more slowly than usual; or the rope became entangled with the wire pennants hanging from the buoy.

The master's view and line of sight towards the mooring deck and buoy were impaired by the vessel's structure. At that time, there was no one available to guide the master: the mate who should have supervised the deck operation and communicated with the master was late for work; and a senior deckhand who was temporarily filling the post went to the toilet after he relayed the master's signal to cast off the mooring rope. The master was waiting a signal from the senior deckhand that the rope had been retrieved not knowing that he had gone to the toilet.

The mooring rope was being recovered over the bulwark, not through the fairlead, and it is most likely that the deckhand was standing in a bight of the rope. The ferry crews had each developed their own systems for unmooring, and the deckhands had their own techniques for rope retrieval. There were no guidelines on whether ropes should be recovered by leading them over the bulwark or through fairleads.

A number of the working practices used on board clearly demonstrated an erosion of the best practices the crew members had been taught. The probable cause of this erosion of standards is likely to have been task familiarity and the repetitive nature of the work. The

deckhand is likely to have complied with the custom and practice followed by his senior colleagues on board.

The lifejacket worn by the deckhand, but unsecured, was not fully supporting his face from the water. Recovery of the deckhand from the water was extremely difficult due to unavailability of suitable equipment for the recovery, and the height of the workboat's freeboard and bulwark.

The unmooring operation was a routine task but it had not been captured by the company's safety management system. Consequently, the very real hazard posed by the rotating propeller blades during the task had not been formally recognized. A review of the risk assessments and operational procedures had been conducted by managers who had been deck crew and masters on the ferries in the past, which might have hampered their ability to carry out an impartial evaluation of the work systems.

What can we learn?

- Detailed procedures for unmooring should be included in the safety management system, and the possible hazards during unmooring operation should be identified.
- A vigilant supervisor, monitoring the situation and giving appropriate guidance to the master and deckhands, could have prevented the rope from becoming jammed and have warned the deckhand about standing in a bight.
- Without adequate supervision, the unmooring process was inherently unsafe and should have been recognized as such through the company's risk assessment process.
- Communications would have been improved by the use of hand-held radios, and the master handing a radio to a nominated acting mate would have removed ambiguity as to their role.
- There are benefits to having independent marine experts assist with the review of the vessel's risk assessments and operational procedures to identify the risks of the prevailing shipboard customs and work practices.
- All workboats on the river could be called upon to assist in water rescue, and therefore should carry suitable equipment for this task.
- The dangers of rushing to get underway before critical crewmembers are stationed at their designated post.
- The dangers of a vessel operator mooring a vessel without a direct line of sight to the mooring crew.
- The dangers of vessel operators mooring a vessel without establishing an effective and positive means of communicating with the mooring crew.

Who may benefit?

Shipowners, operators and crews.

FATALITY (III 1)

Very Serious Marine Casualty: Fatality during a rescue boat exercise

What happened?

A rescue boat exercise was planned as a monthly drill. Prior to launching, launching procedures were discussed among the participants of the drill. The hook arrangement was checked. The crane and its limit switch were tested by lifting and slewing the rescue boat. The rescue boat was suspended by the hook arrangement consisting of an off-load hook and a swivel. The swivel was composed of a fork end shackle and a green pin shackle. The fork end shackle was secured by a shackle pin and a split pin. An AB embarked the forward starboard side of the rescue boat. Then he moved to its forward port side, positioning himself in the boat. The chief officer embarked, took two steps forward, and passed to the port side. Suddenly, the rescue boat fell approximately 18 metres to the water.

The chief officer was seriously injured and the AB was found dead. After the accident, it was found that the split pin was broken off and the actual way in which the swivel was mounted was different from that designed.

Why did it happen?

The visible part of the split pin on the shackle pin had broken off, and the shackle pin came free from the fork end shackle of the swivel, resulting in the fall of the rescue boat. Safety of the rescue boat during its launching and recovery from the water relied exclusively on the condition of the split pin.

An approval of the rescue boat crane arrangement was delegated to the classification society by the flag State. The classification society did not take into consideration the design of the system of the rescue boat crane and the appropriateness of its individual parts. There were no controls to reduce the level of risk associated with the failure of the split pin.

Although weekly inspection of rescue boats, including the condition of the hook, is regulated by SOLAS, the deck officer in charge might not have checked the swivel or the split pin. The ship's SOLAS Maintenance Manual did not mention weekly inspection of the swivel or the split pin.

What can we learn?

- Crews need to be aware of the risks associated with crewmembers riding in rescue boat as they are lowered and hoisted during drills. Further guidelines on safety during similar type drills can be obtained in the IMO document MSC.1/Circ.1206/Rev.1.
- All hazards associated with the hook arrangement of a rescue boat should be identified at the design phase because it is difficult to take into consideration any non-identified hazards through the subsequent risk management process.
- The risk management process should continuously aim to reduce the level of risk identified with regard to the hook arrangement until it becomes acceptable to the management company.
- Since the hook arrangement is a very important safety item, it is essential to confirm that the actual arrangement remains in line with that designed.
- The management company should give shipboard personnel instructions to ensure the weekly inspection of a rescue boat, including the condition of the hook.

Who may benefit?

Flag States, recognized organizations, crane and rescue boat manufacturers, ship builders, shipowners, operators and crew.

FATALITY (III 1)

Very Serious Marine Casualty: Fatal accident in personnel lift (elevator) shaft

What happened?

To inspect the lift shaft pit, crew members tried to open the lift door while the lift was parked and disengaged on an upper deck. They did not succeed, so the chief engineer climbed onto the top of the lift through the top hatch, probably to find out how the doors were to be opened. He then closed the hatch after him. The second engineer reset the emergency stop because he thought, incorrectly, that the chief engineer had taken manual control of the lift. Hence, the lift went to normal operation, and started. The chief engineer was subsequently trapped and killed.

Why did it happen?

- Lack of knowledge about the system. The crew members did not know how to operate the lift doors.
- Lack of communication. The second engineer did not know the intention of the chief engineer. He reset the emergency stop which he thought would allow the chief engineer to manually operate the lift.
- The fact that the hatch on top of the lift was closed removed a safety barrier.
- The company had not successfully implemented the safety management system: a risk assessment had not been completed; safe systems of work had not been established; work permits were not used appropriately.

What can we learn?

- The SMS should be implemented in practice (and not only in theory). If it had been, this accident might have been prevented. Proper implementation of the SMS needs to be considered seriously by companies and designated persons. To succeed in implementing an SMS, there has to be commitment from the top.
- A risk assessment conducted before doing a job identifies the risks and makes it possible to prevent accidents.
- Communication between crew members may prevent many accidents.
- Technical safety barriers should not be by-passed.
- When the SMS is substandard, the risks of individual unsafe acts increase.

Who may benefit?

Shipowners, operators and crews.

FATALITY (FSI 21)

Very serious casualty: Fatal fall into cargo hold

What happened?

During cleaning of cargo holds by ship's crew while the ship was underway at sea, the residual cargo of iron ore was removed from the bilge wells and placed in a pile in each hold before being lifted up by means of buckets and a portable davit to the deck for disposal. The quartermaster and the oiler climbed down to the bottom of a hold to fill the bucket. The cadet operated the winch and the bosun worked the davit and directed the cadet. The bosun connected an empty bucket to the cargo runner and signalled the cadet to hoist it. Once the cadet had hoisted the bucket clear of the hatch coaming, he stopped hoisting but the winch ran on a little. The bosun swung the davit over the hatch coaming and then told the cadet to lower the bucket. But it did not move and the cargo runner went slack because the bulldog grips attaching a shackle to the wire were jammed at the head of the davit in between the sheave and the davit head. The bosun climbed onto the hatch coaming, walked along the top of it and grabbed hold of and pulled on the bucket trying to release the shackle from the davit head, but it did not come free. Then he pulled on the bucket again and, as he did so, the davit moved. As the davit moved, the bosun lost his balance and fell into the hold. He died of the injuries he sustained.

Why did it happen?

A working at height permit was not issued before the bosun climbed onto the hatch coaming and the risk controls that such a permit required were not implemented.

On board safety culture had not be fully and effectively developed as reflected by crew who did not take the opportunity to improve the future safety by engineering a solution to a known problem (jamming of cargo runner of portable davit); and the bosun who disregarded the SMS requirements relating to working at height and climbed onto the hatch coaming of the open cargo hold.

What can we learn?

Take note of small problems and work out safe solutions. In this case, the cargo runner of portable davit became jammed in the head of the davit when the bucket was being hoisted too high. The situation could have been improved or avoided if a mark had been put on the cargo runner to indicate to the winch operator when to stop hoisting, or if a preventer had been fitted to the cargo runner to prevent it from jamming in the head of the davit. Crews should never work at height without the proper safety procedures being implemented.

Who may benefit?

Seafarers.

FATALITY (FSI 21)

Very serious casualty: Crew member loss of life as a result of an infectious disease

What happened?

After leaving port, a crew member reported that he had a headache and chills to the Chief Officer. Believing that the crew member had a cold, the Chief Officer provided cold medication although the master was the designated medical care officer. The next day the crew member was given pain relievers from muscle aches. The crew member continued to work as usual for the next 3 days until, while working on deck during the morning, he was sent to his cabin to rest. The crew member's temperature reached 42°C and the Chief Officer called the International Radio Medical Centre. Malaria tests were conducted and were positive for the malignant malaria type *Plasmodium Falciparum*. The crew member was given Malarone tablets, but he was vomiting repeatedly. The ship altered its course and increased its speed in order to reach a position where evacuation by helicopter would be possible.

Throughout the day the ship provided observations on the crew member's condition and received instructions from the Radio Medical Centre. Early in that evening, however, the crew member died.

Why did it happen?

The crew member was most probably infected with the virus during the port stay.

Medicine on board was not managed properly by qualified crew. The procedures used on board the ship did not ensure that only the designated medical care officer handed out medicine to the crew members.

Due to the port being situated in a "No or low risk of malaria area", the shipowner and shipboard management considered it unnecessary to prepare such a risk assessment, and no risk assessment was made considering local conditions.

What can we learn?

The importance of ensuring that all crew members are made aware of what diseases may be present at port, how to minimize contracting the diseases and their symptoms.

The importance of notifying the designated medical care officer of any symptoms exhibiting by crew members as early as possible.

Malaria medicine to be administered intravenously exists (which is available at hospitals) and could possibly have ensured that the medicine given was effective and not rejected.

Who may benefit?

Seafarers, shipowners and operators.

FATALITY (FSI 21)

Very serious casualty: Man overboard while securing pilot transfer ladders

What happened?

While a 12,000 gross tonnage containership was at sea, the chief mate told the bosun and ratings that because of heavy weather, the previous day's standing order/work permit that no one was allowed to work outside the accommodation without permission from the master or chief mate was still in force.

At a watch change, the bosun told both the relieving rating and the relieved rating to follow him onto the foredeck in order to secure the pilot transfer ladders. The relieving rating, unaware of the chief mate's order because there had been no handover by the relieved rating, followed the bosun outside of the accommodations. Although aware of the standing order/work permit, the relieved rating did not dare challenge the bosun's order.

After securing the starboard side ladder they crossed over to the port side, the windward side, to secure the port side ladder. While the two ratings were working on it, the bosun was walking toward the accommodation on the port side, when he was washed overboard.

Immediately after the accident, rescue efforts by the ship, passing ships and the Rescue Coordinating Centre were initiated, but the bosun was not found.

Why did it happen?

The bosun did not follow the chief mate's instructions that prohibited working outside the accommodation. The bosun did not consult with the master or the chief mate about a work permit prior to the work on foredeck.

The relieved rating did not hand over the chief mate's instructions to the relieving rating, who had no concerns about working on the foredeck, resulting in acceptance of the bosun's work order.

The bosun went to the foredeck due to concerns about whether the pilot transfer ladders had been properly secured.

What can we learn?

The chief mate's instructions to crew on daily work under the conditions of heavy weather should be followed, and standing orders/work permits should be signed by the master or the chief mate before commencing the work.

The crew should be encouraged to discuss the decisions made by their superiors when having doubts or concerns about safety.

Safety notices should be posted on the accommodation doors leading to outside alleyways when work on deck is prohibited

When heavy weather is anticipated, the pilot transfer ladders and other movable objects on deck should be secured prior to the departure.

Who may benefit?

Seafarers, shipowners and operators.

FATALITY (FSI 21)

Very serious casualty: Worker trapped in unloading equipment

What happened?

A 20,000 gross tonnage bulk carrier was berthed alongside and discharging cargo. Around midnight a wiper was stationed in the ship's conveyor belt tunnel to monitor the conveyor. He was equipped with a walkie-talkie to communicate.

On a routine round of the cargo system, the chief mate found the wiper trapped between the running conveyor belt and roller. The chief mate immediately activated the emergency stop button for the conveyor belt, sounded the alarm and called for assistance. The wiper had already died from his injuries.

Why did it happen?

Although safety meetings were conducted monthly, the chief mate and watchkeeping mates did not confer with the wiper about the risks he would encounter before commencing the task in the tunnel. Furthermore, there was no specified loading and unloading instructions on the conveyor belt tunnels. The wiper neither might have become aware of the hazard nor have known how to react when he spotted the irregularities in the tunnel.

Since no risk assessment of workplace was conducted after the installation of guard rails by the company, measures taken were inadequate to prevent the wiper from getting trapped in the running conveyor belt and to alleviate the damages caused by it. As the result, the wiper was trapped and could not stop the operation of the conveyor belt.

What can we learn?

To ensure that seafarers can work in a safe environment, it is imperative that companies conduct a hazard identification and risk assessment and that proper control measures are put into place.

Work instructions and standards operating procedures, which reflect the risk assessments and control measures, should be developed and that seafarers are properly familiarized with their use.

Before commencing the task, it is important to make sure that safety issues are communicated among the officers and crew.

Emergency stops should be placed so that they are immediately in reach of the seafarer at his working location.

Who may benefit?

Seafarers, cargo owners, shipowners and operators.

FATALITY (FSI 20)

Very serious casualty: fire in crew accommodation and death of an oiler

What happened?

On a 17,000 gt cement carrier, while in port, a fire broke out within the crew accommodation and spread very rapidly. An oiler was trapped and disoriented by the intense heat and dense smoke. He was later found unconscious inside his cabin and declared dead by a doctor on arrival in the hospital.

Why did it happen?

The vessel's keel was laid in 1967. Being 42 years old, the provisions of SOLAS 60 applied in respect of fire integrity and division. The partitions within the accommodation inside the upper deck were made out of wood and doors to corridors to different decks were also made out of wood. These wooden constructions caused a very rapid spread of fire.

The location of the fire-fighting lockers was near the entrance inside the crew accommodation on the upper deck. There were no emergency escape breathing devices (EEBD) provided on board, and the escape routes were not properly marked with photo luminescent strip indicators.

What can we learn?

- Crew members working on board vessels of old construction must be alerted to the associated hazards and risks they may be facing and the need to be prepared for them.

FATALITY (FSI 20)

Very serious casualty: fire in crew accommodation and death of crew members following the evacuation of the ship

What happened?

While a 16,500 gt bulk carrier was at sea, crew members sighted a fire inside a crew cabin. They attempted to extinguish the fire by portable fire extinguishers and fire hoses but failed. Sixteen crew members including the master, chief officer and chief engineer evacuated the vessel into a life raft, leaving behind 8 other crew members who refused to abandon ship. No distress signals were sent prior to or upon abandoning ship. The fire spread to all levels of the crew accommodation, but extinguished naturally after about 6 hours. The 8 crew members on board were rescued by another vessel six days after the accident. The 16 crew members evacuated from the vessel were missing. The search and rescue operation was seriously delayed because the master neither informed the company about the fire nor activated distress signals when evacuating the vessel. In addition, the company did not alert any rescue centres immediately after losing contact with the vessel for more than one day.

Why did it happen?

It is probable that the fire started when a fitter used a portable heater/stove for cooking inside his cabin and ignited combustible material nearby. No fire alarm sounded and the fire was sighted by some of the crew members, who attempted to put out the fire using portable extinguishers and fire hoses. But, the extinguishers were not working and water was not available from the hoses. The fire went out of control and spread throughout the crew accommodation.

The master and the chief engineer made no further attempts to contain and fight the fire, and they abandoned the vessel instead of retreating to a safe position in the forward part of the vessel.

The company did not carry out regular internal safety audits of the vessel for identifying inadequacy in the implementation of the shipboard safety management system.

What can we learn?

- Use of appliances that can cause a fire hazard inside crew cabins should be prohibited.
- Education for crew- members in fire safety awareness should be provided.
- Routine maintenance, inspections and testing of fire fighting and life-saving appliances, including drills and exercises for enhancing crew training in their use, should be carried out effectively.
- Communication between management companies and masters of vessels must be effective so that shore support can be rendered to the vessel in an emergency.

FATALITY (FSI 20)

Very serious casualty: crew member fatality during deck maintenance

What Happened?

A 6,200 gt general cargo ship was at sea, and the ship's crew were using tools, including an electric angle grinder, to prepare areas of the forecastle prior to painting, when an unexpected wave washed over them. One of the crew members, who was holding the running angle grinder at the time was electrocuted and washed off the forecastle onto the main deck. The ship's crew attempted to resuscitate the injured crew member and tele-medical advice was asked for and provided. However, the crew member died as a result of his injuries.

Why did it happen?

The crew did not appropriately consider the risks associated with working with electric power tools on the ship's forecastle while at sea.

The ship's SMS did not require the crew to carry out a formal risk assessment before they started work.

What can we learn?

- Formal risk assessments are not a paperwork exercise to appease management but an effective tool to be used on the job to ensure that all risks are considered and that appropriate risk controls are in place before hazardous work is carried out.

FATALITY (FSI 20)

Very serious casualty: man overboard/falling overboard while rigging pilot ladder

What happened?

A 25,500 gt containership commenced sailing from berth at a river port. It was still dark in the morning. The weather was cold, drizzle prevailed and froze in places on deck. The ordinary seaman at the forward station heard the master's order over the radio to prepare the pilot ladder for pilot transfer. He told the second officer at the station that he would go to the pilot station and then proceeded to the pilot station alone. Another ordinary seaman from the aft manoeuvring station, who usually deployed the pilot ladder together with him, was occupied at the aft station for securing the towline of the tugboat. When he later arrived at the pilot station from the aft manoeuvring station, he did not see anybody there.

Why did it happen?

It is suspected that after the first ordinary seaman deployed the pilot ladder and secured it with ropes, he opened the pilot gate to also prepare the stepping platform, which was made of aluminium and weighed about 17kg. The hinged claws of the stepping platform may not have been engaged in the intended retainers. While then lowering the stepping platform it toppled and fell over the shipside. The seaman, using a thin cord wrapped on his hand for lowering the platform, was pulled into the water.

The arrangement of the pilot station posed a risk to the crew members. The arrangement consisted of an electrically operated pilot ladder reel installed beside the narrow passageway on deck and the aluminium stepping platform which needed to be deployed by a thin cord and lowered manually by hand with the pilot gate on the railing opened.

The safety awareness of the seaman was inadequate despite of his qualification and training. He did not wear a personnel floating device nor was he secured with a line, even though mounting the platform and fitting the handrail required a shift in the body's centre of gravity over the side of the vessel. Moreover, he might have considered it as a routine job and hence acted alone.

Working in the dark with poor lighting and a partially slippery deck near the open pilot gate also contributed to the accident.

What can we learn?

- Standard and routine tasks are prone to being underestimated in terms of the associated risk of injury. It is important that appropriate measures are implemented to break down the routine on board and that it is regularly pointed out work that is in essence potentially hazardous.
- A prior risk assessment of the operating system by the management would enhance the work procedure and result in appropriate safety training for the crew as well as the selection of necessary personal protective equipment during work.

FATALITY (FSI 20)

Very serious casualty: man overboard/fall while transferring from pilot ladder to tender

What happened?

While at anchor a master and a crew member were preparing to disembark from a 42,000 gt container vessel and board a tender to be taken ashore. It was early morning and the seas were relatively calm.

After making his way down the accommodation ladder and descending the pilot ladder, the master boarded the tender with the assistance of a deckhand. The crew member then made his way down, but as he was about to board the tender with the assistance of the deckhand, he fell into the water. After swimming a few strokes he was unable to keep his head above water. He quickly drifted in the current to the stern of the vessel where his body was caught by the crew of the tender; However, attempts to bring him on board the tender were unsuccessful because of the weight of the crew member, the high freeboard of the tender, and the car tires around the tender which were being used as fenders. The crew member died before he was finally recovered from the sea.

Why did it happen?

Neither the master nor the crew member was wearing a flotation device.

Disembarking the vessel using the pilot ladder was not the usual method.

It is probable that the exertion of swimming led to an acute medical condition that preceded the drowning.

What can we learn?

- The importance of wearing a flotation device when using pilot ladders.
- Climbing or descending a pilot ladder involves some risk for which crew members should have appropriate training or instruction.
- The importance of medical fitness for service at sea given that crew members may be exposed to stressful situations demanding high levels of exertion.
- The importance of suitable tenders for crew transfer operations and recovery.

FATALITY (FSI 20)

Very serious casualty: falling from height during inspection of water ballast tank

What happened?

On board a 37,000 gt containership whilst at sea, the chief officer entered into a water ballast tank for a routine inspection. Before the entry, he measured the tank's atmosphere. He descended through the open manhole into the darkened tank, holding the lit torch in one hand. The bosun stood at the tank access monitoring the chief officer's progress and an AB stood behind the bosun. The chief officer stopped at the fifth or sixth rung of the vertical ladder, almost level with a transverse stringer through which the ladder continued. He took another reading from the gas analyser and informed the bosun that the oxygen level was between 20.8 per cent and 20.9 per cent. The chief officer then stepped to his left onto the

stringer. At the same time, the bosun stepped back from the access and started talking to the AB. A few seconds later, there was a loud crashing sound in the tank. The bosun illuminated the tank with his torch and saw the chief officer lying at the bottom of the tank. The officer was recovered and air-lifted to the hospital for medical treatment, but was declared dead before arrival. As the chief officer stepped onto the stringer moments before he fell, it is almost certain that he fell off its un-guarded edge, possibly as a result of slipping on the sludgy coating while holding his torch in one hand and the gas analyser in the other.

Why did it happen?

The precautions taken by the Chief Officer before entry into the tank fell significantly short of the requirements of the vessel's procedures, the expectations of the vessel's managers, and industry best practice.

The chief officer did not follow the permit to work system on board for entering into enclosed spaces.

The danger of falling during tank inspections had not been recognized or considered as no permits to work aloft were issued for tank entries on board.

What can we learn?

- It is important to follow the permit to work system for entering into enclosed spaces on board and that if there is a danger of falling from height, the precautions for working aloft must also be considered.

FATALITY (FSI 20)

Very serious casualty: falling from height after cargo hold cleaning

What happened?

While at sea, the crew of a 27,000 gt bulk carrier were carrying out hold cleaning in preparation for the next voyage. After No.2 hold been cleaned, they had started cleaning of No.3 cargo hold, using hydrochloric acid. At that time, the ladders inside the hold were wet due to passing showers, and the vessel was rolling moderately. As the hatch cover was to be closed for the night, the two crew members working inside the hold came up from hold using the ladders. One crew member used the forward vertical ladder, the other used the aft ladder. The one crew member using the forward ladder fell from the ladder and died.

Why did it happen?

The vessel was rolling moderately. The top of the vertical ladder was slippery due to the passing showers.

The seaman may have been tired at the end of what had been an arduous day's work in tropical conditions. While climbing, the crew member did not use a safety harness and was wearing gloves that were slippery due to water. He did not wear a full protective face mask. The seaman may have been distracted as a result of a mixture of perspiration and hydrochloric acid and that would have caused irritation to his skin and/or eyes. The personal protective equipment that the seaman was wearing, or carrying, may have increased the difficulty he experienced while climbing the cargo hold ladder.

No thorough safety assessment on cleaning work covering all associated risks, including weather had been conducted before starting work. The ship's crew did not adequately consider all of the risks associated with cleaning the cargo holds with hydrochloric acid. The ship's crew were not aware of the safety information provided by the material safety data

sheet. The ship's safety management system was not effective in ensuring that the crew carried out a formal risk analysis for the hazardous task of preparing the cargo holds with hydrochloric acid.

What can we learn?

- Crew fatigue should be managed in accordance with ILO Convention to prevent fatal accidents on board.
- A formal risk analysis for hazardous tasks must be carried out properly before starting work and personal protective equipment should be worn until the work is completed.
- Essential safety information for dangerous material should be provided on board and the crew must be well-acquainted with it.

FATALITY (FSI 20)

Very serious casualty: falling down the stairs on the main deck

What happened?

At about daybreak, a crew member walked through an access way to descend the exterior stairs to the main deck of a 7,500 gt general cargo ship. The crew member, who was wearing a hard hat, fell down the stairs, hit his head on the studs of a manhole cover and subsequently died. The crew member had in his possession a flashlight, but it was found turned off.

Why did it happen?

Although it could not be determined what caused the crew member to fall down the stairs, he either tripped over a 5 cm raised lip along the top of the stairs or lost his balance while descending them. The stairs were steep and the handrails were installed only along the top half of the stairs.

The 5 cm raised lip along the top of the stairs was not adequately marked as a hazard.

The top and bottom steps of the stairs were painted yellow but the paint was worn.

There was no lighting installed in the vicinity of the stairs.

What can we learn?

- The importance of identifying tripping hazards and taking measures to eliminate or minimize them.
- The importance of verifying that measures taken to address a hazard continue to be effective.
- Handrails should be installed along the entire length of the stairs.

FATALITY (FSI 20)

Very serious casualty: fatal accident during hatch cover operation

What happened?

After loading of No.1 lower cargo hold was finished, the chief officer of a 5,000 gt general cargo ship was closing the tween deck hatch covers of the hold assisted by a seaman. While the crane driver hoisted the hatch cover, the officer remained standing on it at the forward starboard end. The hatch cover was observed to have moved approximately 0.5 metres aft when the T hooks at the aft side were seen to release, followed very quickly by the T hooks at the fore end. The officer and tween deck hatch cover fell, with the hatch cover finally landing on and fatally injuring the officer.

Why did it happen?

The planning of the lifting operation was inadequate. The dedicated hatch cover crane had not been used to move the tween deck hatch cover. The outer casting for moving the tween deck hatch cover had not been used to fix the T hooks. The T hook locking arrangement was not satisfactory due to excessive clearance and movement inherent in the design.

The familiarization of the chief officer following a return to duty was not undertaken in a satisfactory manner. He did not recognize the safety risks inherent in remaining on the hatch cover when it was moving, and he did not mitigate the risks of working at height.

Risk assessment techniques and other safety management tools were not conducted properly.

What can we learn?

- Never ride on a load being lifted unless the lifting appliance used is designed for lifting or lowering personnel.
- Ship equipment should be maintained and used in accordance with manufacturers' instructions.
- A risk assessment for all potentially dangerous work on board must be conducted in advance.
- Newly joining crew members must be given enough time for them to be well acquainted with the ship's systems.
- Manufacturers must ensure that ships' equipment is of a safe design to mitigate potential dangers to the crew.

FATALITY (FSI 20)

Very serious casualty: fatal accident during cargo operation

What happened?

The deck crew of a 33,000 gt bulk carrier was securing a gantry crane. Two crew members went up into the crane to start the necessary work there. After preparing the crane for stowage, the four main jibs had to be swung in.

Swinging in of the jibs is done from a manoeuvring panel on a platform below the crane's forward port leg. A third crewmember went to the manoeuvring platform to swing in the jibs.

After confirmation that all crew were in a safe position, the four jibs were set in motion. Subsequently, and without notifying the other crew involved, two crew members on the girders of the gantry crane identified that the end stopper hatches located in the protective walls needed to be open. The two crew then immediately went and opened the end stopper hatches. Following that, one crewmember was found struck and killed by the end stop of the starboard aft jib.

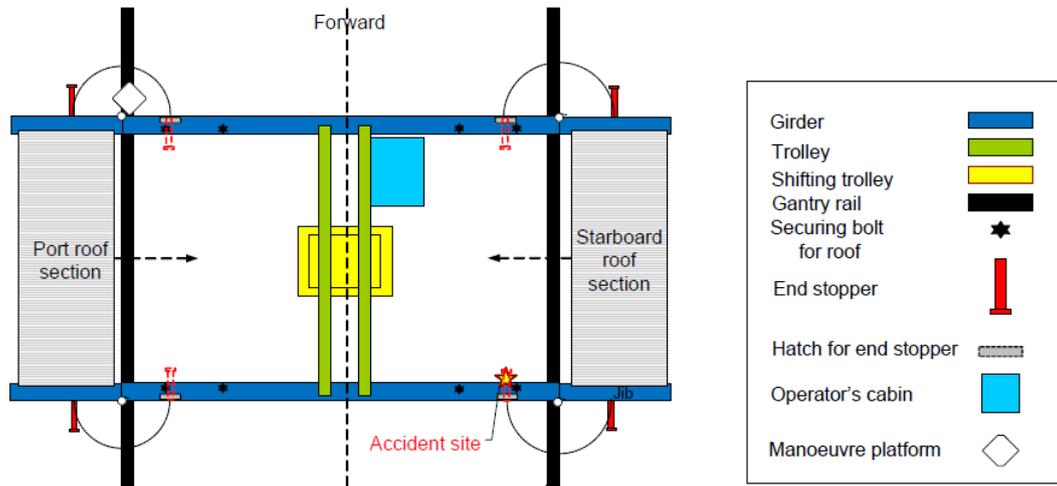


Figure 1: Simplified drawing of the gantry crane seen from above.

Why did it happen?

The accident occurred while the boatswain was on the walkway as the jibs were swung in. The end stops installed on the jibs to secure the trolley, move in through the crane's forward and aft protective walls and pass the girders, and hence the walkway. It has not been possible to ascertain why the boatswain was in the area.

After having opened the hatch for the end stop, he may have given his attention to checking the chain to be attached to the T-shaped securing bolt in the aft corner of the starboard sliding roof section. This is based on where the boatswain was hit and the position in which he was found.

What can we learn?

- Risk assessment for all work on board should be carried out beforehand with necessary measures and crew should pay attention including proper communication, observation of safety regulation etc during work.
- Area with moving parts introducing risk of crushing crew members should be closed off, clearly marked with appropriate signs and warning lights/alarms.

FATALITY (FSI 20)

Very serious casualty: lifting appliance failed leading to loss of life

What happened?

Modifications were being made to the top of a diving bell on a 9,000 gt diving support vessel. The vessel was at sea at the time, undergoing sea trials after a dry docking period. The newly installed winch supporting the diving bell's 4 tonne cursor suddenly rendered, allowing the cursor to drop suddenly over the top of the diving bell. (The cursor is a steel cage which is lowered over the top of the diving bell to protect it while it passes through the moonpool). A rigger, working on top of the bell, was trapped between the cursor and the bell. He was airlifted to hospital within 30 minutes of the accident but was pronounced dead soon after arrival.

Why did it happen?

The cursor winch was newly installed as part of a modification of the bell arrangement and at the time of the accident the system had not been commissioned or load tested since assembly on board.

The person operating the winch left the operating position after shutting the hydraulic power off. The action of shutting the power off should have left both winch brakes engaged, but a faulty pilot valve caused the winch brakes to malfunction.

The cursor was not positively supported (e.g. by strops or blocks) at the time of the accident. Cursor supports and securing devices, provided to give positive support to the cursor during bell handling operations were not deployed.

What can we learn?

- It is extremely inadvisable to place any confidence in the safe operation of machinery that has not been fully commissioned and which therefore has not been properly tested.
- Do not use lifting appliances which have not been proof tested and certified fit for purpose.
- Never carry out maintenance or modification work under a suspended load without first ensuring the load has been positively supported by additional means.
- Do not leave winch controls unattended while a load is suspended.

FATALITY (FSI 20)

Very serious casualty: explosion while cutting off the top of a steel drum leading to loss of life

What happened?

An engine-room rating serving on board a 23,132 gt multipurpose ship was fatally injured when using a pneumatic angle grinder to cut the top off a 200 litre steel drum. The drum exploded, hitting the rating with great force. He later died as a result of his injuries.

Why did it happen?

The drum had contained a flammable oil. It had not been thoroughly washed out and ventilated. The drum sealing caps were left in place during the grinding operation. The angle grinder produced heat and sparks during its use to cut the top off the drum. The vaporized oil/air mixture was ignited by heat from the grinding operation.

An appropriate risk analysis was not undertaken and a hot work permit was not completed for the task.

What can we learn?

- When disposing of, or modifying drums which have, or may have contained, flammable substances, cold cutting techniques should be used. Any techniques likely to generate heat or sparks should only be used after the container has been thoroughly cleaned and gas-freed.
- If occasions occur on board where crew members are found using cutting or burning gear without the prior issuance of a hot work permit, consideration might be given by the Safety Officer to having such equipment maintained in a locked store and requiring issuance of a hot work permit as a pre-requisite of releasing the equipment for use.

FATALITY (FSI 20)

Very serious casualty: falling overboard during preparation for fishing

What happened?

A 140 gt trawler departed from port after boarding 4 crew members.

Whilst connecting the bridle on the port side, one crew member fell backwards over the bulwark on the aft quarter main deck.

Rescue was delayed and the casualty died due to cardio respiratory arrest secondary to drowning.

Why did it happen?

The crew did not wear personnel floating devices, and the casualty, reportedly, looked "distracted" during working.

What can we learn?

- Crew should pay utmost attention to dangerous work on board.
- Crew should wear personal safety equipment including personnel floating device, etc., whilst working on deck.

FATALITY (FSI 20)

Very serious casualty: falling overboard while returning to home port

What happened?

A 36 gt gillnetter was en route to its home port, which was about 16 miles away. Weather was good, seas were 2 metres and the water temperature was 7 degrees Celsius. The master was at the wheel, four crew members were forward hauling in the nets and one crew member was aft. The crew member aft exited the compartment for stowing the nets and was climbing down the rungs of the access ladder to the compartment and fell overboard. A few minutes later the crew noticed the crew member was missing and raised the alarm. The vessel was turned around to search for the crew member. About twenty minutes later the crew member was spotted motionless on the sea surface. The crew was unable to retrieve the crew member from the water, and he was never recovered.

Why did it happen?

It is likely the crew member lost either his footing or his grip while he was climbing down the rungs. The access ladder to the compartment – which is located beside the port bulwark and extends up beyond the height of the bulwark – was draped over with nets. Also, the crew member was seen to be carrying clothing items in one hand.

The crew member was alone in an area that could not be well seen from the wheelhouse and there were no means in place for communications.

The crew member was not wearing a personal flotation device.

There was no adequate means on board the vessel to retrieve a man overboard.

What can we learn?

- The importance of wearing a personal flotation device or flotation workwear when working in areas where there may be a risk of falling overboard.
- The dangers of climbing or descending ladders while carrying items in one hand.
- The importance of maintaining communications or visual contact with crew members working alone or in isolated areas.
- Ensuring a means of retrieval from the water on board vessels with high freeboard.

FATALITY (FSI 20)

Very serious casualty: man overboard/falling overboard while stowing nets

What happened?

A crew member on board a 300 gt fishing vessel had fallen overboard while stowing fishing nets on top of the flying bridge. He was unable to reach the various lifesaving devices that the other crew cast to him. The crew then tried launching the rescue boat but it was not connected to its launching device and once it was launched, the engine would not start. The crew member's body was eventually recovered on board about 1.5 hours after he fell overboard. He could not be revived.

Why did it happen?

The crew were not well practiced in techniques for retrieving persons from the water and the rescue attempts were constrained by the fact that the rescue craft was not in a good state of readiness and not in a good state of repair.

What can we learn?

- If crew members fall overboard or end up in the water due to an accident their chances of survival will depend on the speed of the crew response, and how well the response has been planned.
- Survival craft and equipment must be in a state of readiness and in good working order if they are going to be effective in saving lives.

FATALITY AND INJURY (FSI 19)

Very serious casualty: fatality and injury caused by excessive rolling of a large container ship during a typhoon

What happened?

The about 95,000 gt, partially loaded, container ship rolled severely at sea during a typhoon. As a result, several crew members on the ship's bridge lost their footing, including the Master, the helmsman and the lookout. The helmsman managed to regain his footing, but the Master and lookout were thrown violently across the wheelhouse. The lookout subsequently died and the Master suffered serious injuries, necessitating in his medical evacuation. Four more seamen suffered minor injuries.

Why did it happen?

The vessel had to leave port rapidly due to an approaching typhoon. Consequently, it had not finished loading and had an exceptionally high GM (7.72 m). After departing the confines of the port, the ship encountered a violent wave from starboard just as it rolled to starboard. Due to the proximity of land, the Master was unable to take a heading which would have lessened the rolling effect of the swell. The vessel's design, coupled with its low speed at the time of the incident, resulted in poor roll damping. As a result, the ship rolled an estimated 44° over about 10 seconds. The size of the ship and the subsequent height of the wheelhouse contributed to the violent motions experienced in the wheelhouse. Furthermore, the wheelhouse was very large and there were few grab-rails or handholds for the crew to hang on to in the event of violent weather.

What can we learn?

- The dangers of operating a vessel with a high GM ("Stiff Ship"), especially in heavy weather conditions with limited sea room in which to navigate.
- Decreasing the vessel's speed below a critical value may lead to dangerous deterioration of the dynamic roll damping characteristics of the vessel.
- A risk assessment of working spaces and working areas, should take into account adverse weather conditions. Grab rails, lifelines and seat harnesses may need to be considered.
- Consider the use of hard hats and non-slip footwear, even in work areas such as wheelhouses, which may be considered "safe" – especially in severe weather conditions.
- Be aware of the hazards in heavy swells particularly in spaces located high in the vessel's structure, such as bridges on large container ships.

FATALITY (FSI 19)

Very serious casualty: fatality to crew caused by accidental release of CO₂ gas into engine-room

What happened?

The about 35,000 gt container ship was in dry dock. A test of the fixed CO₂ extinguishing system for the engine-room and holds was planned by the shipyard, but was delayed. The Chief Engineer, assisted by the ship's electrician, decided to carry out the test of the CO₂ system himself. He did not inform anyone about the start of the test. He started blowing lines with air, but he forgot to disconnect the connection to the CO₂ bottles prior to opening the high pressure air valve. Shortly after starting the test, CO₂ bottles started discharging into the E/R. The Chief Engineer was unable to stop the discharge. He activated the CO₂ alarm and the electrician made an emergency announcement using the internal radio system. The Master, upon hearing the alarms and realizing the situation, announced emergency stations on the ship's public address system and ordered an evacuation of the engine-room. About 10 minutes after the accident, rescue operations were started and were conducted with the help of the shipyard rescue team. Several crew members and yard personnel were sent to the local hospital for medical treatment. Later, news of 3 crew member fatalities was received from the hospital.

Why did it happen?

Improper procedures were adopted to blow through the CO₂ system pipelines with air. Had the copper pipes connecting the selection valve to the CO₂ bottles been disconnected, CO₂ would not have been released. The work was planned in an improper way. Senior staff, such as the Engine Superintendents and the Master and Chief Officer, were unaware of the work being carried out by the Chief Engineer on the CO₂ system. The possible consequence of a CO₂ leak in the engine-room was not envisaged. Hence the personnel working in the engine-room were not asked to vacate the area during the testing. They were not even alerted to the operation.

The emergency escape route from the engine-room had been made inaccessible from the outside for security reasons. Had the escape route been made available to the rescue team, the rescue could have been still swifter.

What can we learn?

- Testing of fixed CO₂ systems should only be carried out by competent personnel.
- The procedure for testing of the fixed CO₂ system should be clearly detailed. Any testing of this system should ensure that the set of CO₂ cylinders is fully isolated from the cargo and machinery spaces.
- All jobs being undertaken must include a risk assessment/hazard identification system, where all hazards are identified and steps taken to eliminate, isolate or minimize the risks. These hazards must be further discussed at a meeting, before the job is carried out.
- The security benefits of locking of emergency escape routes must be carefully considered against the loss of the safety benefits that would have been available had the escape route not been locked.
- Senior staff should be well familiarized with fixed fire-fighting systems and of the dangers of accidental release.

FATALITY AND INJURY (FSI 19)

Very serious casualty: fatality and injury to crew caused by hold cleaning rig

What happened?

The about 76,000 gt bulk carrier was at sea, the crew was cleaning cargo hold residues. The weather was good with light winds.

The crew was working with an unapproved, "home-made" lifting rig comprised of a portable boom with wooden blocks and nylon ropes to pick up cargo residues from the hold.

After several hours of work, the makeshift davit's boom failed due to over-heaving of the hoist rope by the winch and the boom struck two crew members who were attending to it on deck. Due to the tension of the hoist rope, the boom gave way at the welding seam and thus caused serious injuries to the attending crew.

First aid was administered on board. Medical help arrived on board by helicopter about 8 hours later. Fifteen hours after the accident, both the casualties were air lifted by naval helicopter to a naval hospital.

One of the crew died en route to hospital. The second crew member was successfully treated.

Why did it happen?

The gear and rigging used for the purpose of lifting cargo from the cargo hold was fabricated on board and unapproved. This made the job conditions unsafe and prone to accident. In addition, the davit was corroded. The winch operator lost attention momentarily and did not notice the marking on the rope. He over heaved the rope using the winch, resulting in the davit boom breaking from the weld and thus causing the casualty.

There was also a lack of attention on the part of the crew member giving signals by walkie-talkie to the winch operator, and the signal to stop heaving was not given in a timely manner. A qualified dedicated signal man was not assigned. There was lack of coordination on communication between the signalman at the lifting boom and the winch operator.

There was a poor situational awareness on the part of the crew who were making use of the unsafe lifting gear – not even knowing that they were working in unsafe conditions which could cause an accident. The risks involved in using the unapproved lifting gear were not identified or understood.

The lifting gear was not checked for any defects or damage prior bringing them into use.

What can we learn?

- Correct work procedures should be complied with.
- Appropriate and approved lifting gear should be used on board.
- Standard work practices involving proper safety regulations should be followed.
- In lifting operations, if the view is blocked, proper signal and communication between the operator and work should be provided.

FATALITY (FSI 19)

Very serious casualty: serious injury and damage to ship/equipment

What happened?

The n° 1 crane of the 1997 built, about 200 m long 28,000 gt bulk carrier collapsed from its foundation, while the vessel was discharging steel scrap in port.

The estimated weight of the load lifted by the crane was 20 tonnes, including the grab.

The crane body suddenly collapsed onto the deck portside, damaging portside main deck railing and the crane house.

The ship's crew was not injured, but the crane operator was badly injured.

Why did it happen?

Due to improper/inadequate maintenance of the crane over an unspecified period of time, the accumulated old grease was not "washed out" prior to the lubrication. Due to this, and possibly influenced by the heavy grab duty, excessive wear of the outer ring of the slewing bearing occurred. The result was a violent separation of the slewing bearing under a heavy load operation.

The manufacturer's "washing procedure" was not followed by the crew.

What can we learn?

- There is a need to have a properly implemented and effective preventive maintenance plan.
- The importance of having in the vessel's ISM manual a specific procedure for all crew members involved in maintenance operations of cranes regarding the manufacturer's maintenance plan.
- Crane operators, preferably crew members, must be competent to safely perform their duties.
- All companies must implement a system of training of the operators.
- Also, port personnel should include properly certified individuals.

FATALITY (FSI 19)

Very serious casualty: fatality, resulting in grounding

What happened?

A small about 50 gt coastal ferry was just clearing port at half ahead speed when the master, alone on the bridge, suffered a heart attack and collapsed. The helm became set hard to starboard, possibly by the master as he collapsed, and the ferry turned towards the shore and grounded hard. Passengers provided medical assistance until the emergency services arrived. The ferry suffered only minor damage, but the master could not be revived.

Why did it happen?

The vessel was licensed to operate with crew of two, but the master was alone. He had allowed the other crewman to leave the ferry earlier in the day to attend to personal business. As a consequence, there was no other trained mariner on board who could have detected that the ferry was not behaving as expected in time to take effective action.

What can we learn?

- Manning should not be reduced below approved levels.
- Single-handed operations carry an increased risk in that if the lone mariner is incapacitated for some reason, there is no one left to navigate the vessel or deal with emergencies.

FATALITY AND INJURY (FSI 19)

Very serious casualty: enclosed space entry causing death and personal injury

What happened?

An ordinary seaman (O/S) and a deck cadet serving on board an about 36,000 gt Panamax bulk carrier lost their lives inside a cargo-hold while undertaking routine cargo temperature measurements at sea. A third crew member, the bosun, seeing the two crew members were in trouble, lost consciousness when attempting to assist them. Shortly afterwards the Chief Officer discovered the three crewmen in the cargo hold and raised the alarm. Members of a rescue party wearing SCBAs recovered the three seamen, but only the bosun survived. The event occurred on a bulk carrier carrying a cargo of coal which was known to be oxygen-depleting and prone to self-heating.

Why did it happen?

The cargo-hold was oxygen depleted. Carbon monoxide may also have been present in the air space above the cargo. According to readings taken on arrival in port the oxygen content in the hold was 14.1%. The reason why the first person entered the cargo hold is unknown but it may be that the thermometer to measure the cargo temperature was dropped or became snagged and the seaman went into the hatch to retrieve it.

The three crew members who entered the space without SCBAs may have done so impulsively and possibly under the assumption that they could survive a brief presence in the cargo space.

The fact that the access hatch was open to enable the temperature readings to be taken must be considered a contributing factor.

What can we learn?

- When dangerous cargoes are loaded that require specific knowledge for the crew, a safety meeting should be held prior to departure, at which all crew should be present, when appropriate advice and instructions should be given. Attendance of each crew member should be acknowledged in writing. The dangers of entering enclosed spaces and the need for responding crew members to STOP, LOOK, LISTEN and EVALUATE the situation for existing dangerous conditions before taking emergency actions should be fully explained. Don't make a bad situation worse by becoming a casualty yourself!
- When intending to carry oxygen-depleting or noxious gas-producing cargoes that require temperature monitoring, provision should be made in advance to enable this to be done without opening personnel access hatches. Measurement of carbon monoxide levels may provide a faster and safer indication of a cargo self-heating than temperature monitoring.
- Prior to carrying out operations involving dangerous cargoes, crews must be informed and understand the proper procedures and preventative measures to be taken.

FATALITY (FSI 18)

Man overboard

What happened?

The crew of the fishing vessel was deploying a series of ground nets from the vessel. A crew member, who was standing on top of the nets adjacent to the ones being deployed, inadvertently connected the bridle of the net to be deployed to the net on which he was standing. When the mooring gear was deployed, the coiled rope of the bridle attached to the net on which crew member was standing caught his leg, dragging him into the water.

Although the net was raised using the winch and the crew member was brought back on board, efforts to revive to him were unsuccessful.

Why did it happen?

The crew member was inexperienced. There were no means used to identify ends of the ropes of each net and which were to be used to attach to a net or to mooring weights. The area where the nets were stowed was in a small enclosed space, which required crew members to stand on the nets adjacent to those being deployed.

What can we learn?

- The importance of having new and inexperienced crew members adequately trained for the tasks they are assigned to, recognizing and taking into account the risks associated with the operations.
- The importance of properly supervising new and inexperienced crew members.
- Caution to be exercised at all times when working near or around gear that is to be deployed.

FATALITY (FSI 18)

Fall from height

What happened?

The ship was en route to the US Gulf with a riding-gang on board. The riding gang were cleaning the ship's ballast water tanks and on the day of the accident they began cleaning the No.4 starboard water ballast tank. At 0806, after the No.4 starboard ballast tank was declared safe to enter, the riding-gang's foreman and one cleaner entered the tank. The cleaner stayed at the top level of the tank to receive some equipment and the foreman proceeded towards the bottom of the tank. A short time later, two more cleaners entered the tank and made their way towards the bottom of the tank. When they reached the bottom of the tank, they could not find the foreman, so they looked around for him. They then discovered him lying on the platform, one level above the bottom plates. He was unconscious and bleeding from a head wound; and from his ear and nose.

The alarm was raised and an emergency team attended the tank. The foreman was placed on a stretcher and taken to the ship's hospital, where his condition continued to deteriorate. At 1000, the foreman was declared deceased.

Why did it happen?

- There were no witnesses to the accident. The report therefore assumes that the foreman slipped and fell while passing from one compartment in the No.4 starboard ballast water tank to another and that he hit his head on a metal structure, leading to a skull fracture and/or cerebral haemorrhage.
- It is not believed that lack of breathable air was a contributing factor in this accident. The weather was calm and the ladders and accesses in the tank were in good condition.

What can we learn?

- Consider the possibility of tripping or falling when carrying out an enclosed space risk analysis
- The importance in keeping a sure footing when working in tanks where there is a danger of falling.
- The importance of wearing and using safety harnesses/fall arresters.

FATALITY (FSI 18)

Injury and death due to heavy seas

What happened?

- The chief engineer was killed and the chief officer was injured after they were hit by a large wave which broke over the ship's forecastle during rough weather. The two men were attempting to secure an anchor chain on the forecastle at the time.

Why did it happen?

- A large wave broke over the forecastle while the two men were tightening the starboard anchor chain, The chief engineer was exposed more than the chief mate and took a large amount of the force from the wave.
- The wave was not seen or felt by those on the bridge, because of the size of the ship.

What can we learn?

- The importance of properly mitigating the risks in going forward during rough weather, to include consideration for adjusting vessel's speed and direction.
- The importance of having appropriate guidance on board to assist with risk identification.

FATALITY (FSI 18)

Two crew members died from asphyxiation

What happened?

Two crew members died from asphyxiation when they entered the ship's forward store where the atmosphere was oxygen deficient. The store's atmosphere had been affected by that of the adjoining cargo hold which was loaded with steel turnings which are liable to self-heating and deplete oxygen in the space they are in.

Why did it happen?

- The cargo hold ventilation ducts passed through the forward store and bellows pieces on the ducts had been cut to drain water and remove cargo residues, which the venting system's design did not allow for. The air in the hold entered the store through the cut ducting.
- The cargo of steel turnings in the hold had depleted the oxygen in the air.
- The forward store was considered a work space and not an enclosed space and the two deceased crew members entered it without informing anyone and were quickly asphyxiated.
- The ship's certification did not allow it to carry that cargo although it could carry other oxygen depleting cargoes. The cargo documentation did not describe the cargo as required by international requirements.
- The hazards of the cargo had increased as it had become wet during loading and had not been compacted because appropriate procedures were not followed.
- The master was provided incomplete and inaccurate information about the cargo but had enough information to try and clarify his doubts about the hazards of the cargo and/or refuse to load it.

What can we learn?

- Ships' masters and crews should consider the risks associated with modifying a system or equipment on board their ships.
- Masters should consider the implications of loading cargoes that they do not have complete information about.
- Precautions should be taken when entering a trunk or compartment adjacent to an enclosed space. The atmosphere may have been rendered unsafe.
- All involved with shipping hazardous cargoes, including shippers, charterers, brokers and terminals should ensure that it is correctly described as required by international codes and appropriate shipping, loading and carriage procedures are followed.
- Compartments adjacent to enclosed spaces should be considered enclosed spaces unless it can be proved otherwise and appropriate precautions taken.
- More education about the hazards of enclosed spaces is necessary.
- The dangers of cargoes that oxidise and deplete oxygen.

FATALITY (FSI 18)

Crew member being crushed by a heavy object

What happened?

During night cargo operations, the body of a crew member was found between the hatch covers. Nobody witnessed the event but his injuries were consistent with being crushed by a heavy object. The ship's cranes were being used to move hatch covers in the vicinity at the time.

Why did it happen?

The deceased crew member was probably standing on the platform between the hatch covers while they were being moved and was probably struck by a hatch cover as it swung or jerked while being lifted. The crane driver might not have seen the crew member in the dark between the hatch covers.

What can we learn?

- Crew and stevedores should stand well clear of suspended loads or loads about to be lifted, and should have an adequate escape path.
- Crane drivers should not begin a hoist if they are not able to see all the hazards around the load or are not being directed by someone who can.

FATALITY (FSI 18)

A passenger fell between the vessel and the wharf

What happened?

While disembarking passengers after a night cruise, a gap opened between the vessel and the wharf. A passenger stepped into the gap, fell between the vessel and wharf, and drowned.

Why did it happen?

The vessel was left steaming against a single spring mooring while the wheelhouse was unattended. The passengers, who were under the influence of alcohol after the night cruise, were left unsupervised while disembarking as the gap opened between the vessel and wharf. The lighting over the disembarking point was poor.

What can we learn?

- There are additional risks associated with steaming against a single spring mooring that should be mitigated if that practice is to be used.
- The wheelhouse should be manned and someone at the engine controls and helm when the engine is still engaged.
- Adequate lighting should be provided at embarkation and disembarkation points on all vessels at any time they can or are being used.

- Passengers should be supervised at all times when embarking or disembarking vessels.

FATALITY (FSI 18)

Crew member being killed when a hatch opened uncontrolled due to increased pressure in hold

What happened?

A cargo hold was being ballasted in preparation for the vessel's maiden ballast voyage and an access hatch to the hold had been inadvertently left closed. A crew member stood on the access hatch in the hold and kicked off the securing cleats. The hatch then flew open under the built-up pressure in the hold and the crew member was propelled up and into the surrounding structures. He died of his injuries.

Why did it happen?

The access hatch was left closed even though it was listed on the ballast procedure as a critical action because there was no cross checking carried out by the responsible officer before pumping commenced.

The procedure was ambiguous because it inferred that the reason for opening the access hatch was to allow water to overflow on deck rather than release air pressure during the ballasting procedure.

The crew member was probably unaware of the built-up air pressure in the hold.

Being the vessel's maiden voyage, and the crew having been on board for only 2 days, they were not familiar – nor practised in the critical procedure.

What can we learn?

- Care should be taken when opening any access that could be under pressure.
- Procedures and associated checklists should include the reason why tasks have been labelled as critical.
- Procedures and associated checklists should be followed and critical tasks should be verified by more than one person including a responsible officer.
- Crew should be allowed ample time to become familiar with a ship, especially when the complete crew is new or has changed.

FATALITY INVOLVING LIFEBOAT AS TENDER

What happened?

A passenger vessel was preparing to depart from a port anchorage area. As it was too big to berth alongside, it was an established practice to transport passengers to and from the shore by the ship's lifeboats operating as passenger tenders. Passengers were on board when the passenger tenders were being recovered.

When one of the passenger tenders was being positioned on the ship's side to be lifted up, the coxswain was unable to bring the tender to exact position under the falls, partly due to the effect of 1.5 knot tidal current and partly due to "slack" in the tender's steering system. The tender lost position and headed towards the ship's side. The falls were positioned too low and the blocks presented a danger to damage the coach house windows. The AB seaman, realizing the danger, left his position aft and moved to the side of the tender to guide the aft block clear. But the tender was moving towards the ship and while the AB seaman was between the coach house and the ship's side, tender set hard onto the side of the ship. The AB was trapped in between and sustained severe crush injuries to his chest. He staggered a few steps before he collapsed in the passenger area of the tender.

The tender was then brought alongside the platform and the ship's doctor was notified. The AB seaman was sent to shore with the tender and transferred to a nearby hospital. Efforts to resuscitate him were not successful and he was pronounced dead at the hospital.

Why did it happen?

The major reason for this accident is the improper adherence to rules and instructions. If the tender crew had had sufficient training in compliance with existing rules, the accident would most likely not have happened.

The training manual states that the tender should be manned by five crew members during recovery. In this case, there were only three crew members in the tender.

There was a small oil leak in the tender's steering system. Although crew topped the oil intermittently, they did not carry out a proper repair and the steering was still sluggish, which influenced the response of the craft. Moreover, the coxswain did not take the prevailing 1.5 knot tidal current into consideration during the handling and was not able to bring the tender to the correct position under the falls. The ship's officers were supposed to supervise the recovery of the tender and give instructions as necessary, but this was not carried out properly.

Although the training manual states that the davit blocks should be raised about 3 metres during approach for recovery, they were hanging close to the water. If the blocks had been raised clear off the water, there would have been no reason for the crew member to leave his position at the aft of the tender and place himself in the dangerous area.

Communications between tender and ship (and amongst tender crew) was poor during the recovery. Ships officers or responsible crew did not notify the tender's coxswain about the tidal current. The crew member in the aft left his position without notifying the coxswain. The coxswain attempted to approach to recovery position although he saw the falls and blocks were hanging close to the water surface without communicating with the ship to make them raise the blocks.

What can we learn?

- The Safety Management System, training manuals and other safety-related instructions are made to enhance safety in various operations. All involved officers and crew should be properly familiarized and trained prior to undertaking shipboard operations. All requirements should be properly implemented and complied with.
- All maintenance and repair works should be properly reported and duly performed. Temporary repairs are not good solutions.

- If there are missing, contradicting or confusing instructions in the ship's various manuals, they should be raised in the safety management meetings or reviews for correction and clarification.
- Safety consciousness is important. Think before acting.

FATALITY DURING INSTALLATION AND RECOVERY OF GANGWAY (FSI 17)

What happened?

Two accidents have been reported involving installation and recovery of a gangway, where in one case the seaman was killed and in the other case the seaman was seriously injured.

Accident one: Two crew members started to set up the handrails on the already lowered gangway while standing on the gangway. The boatswain standing at the top of the gangway lost his balance and fell onto the quay at a height of approximately five metres. From the quay he rolled into the water and sank. He could not be recovered alive.

Accident two: When the ship was preparing to leave port, five seamen started to manhandle the gangway on board. The cook, who came on deck to do his mooring duties, went over to assist five other crew members to tip the gangway over the main deck rails and rotate it into its stowing position. During this operation, the cook fell six metres from the rails into the empty hold. He sustained serious injuries.

Why did it happen?

The immediate cause of the accidents relates to insufficient safety precautions to prevent personnel from falling. In the first case, fall-arrest equipment and floating devices were not used.

In the second case, the passage between the railings guarding the cargo hold, and those guarding the inboard side of the ladder system was only 0.7 metres because of pipes taking up most of the passage. During the work, the cook was partly standing on the pipes to assist guiding the gangway stowage.

In both cases, no risk assessment had been done to identify risks and risk-reducing measures.

Operation procedures and training of personnel were insufficient in both accidents.

The installation of handrails in the first case should have been done prior to the gangway being lowered in accordance with the manufacturer's operation instructions.

What can we learn?

Manufacturer's operation manuals on equipment must be included in the ship's ISM system and training programmes.

Risk assessments should be carried out for both standard and special operations on board ships. Conclusions from the assessments should be included as a part of any training programme on board.

Proper safety equipment must be used when working at height and above/close to the sea.

WATERTIGHT DOOR FATALITY (FSI 16)

What happened?

Two cases have been reported where crew members have been found caught in a watertight door (WT) by co-workers. In one case the seaman was killed while in the other case the seaman suffered severe injuries. In both cases the accidents happened during maintenance work in the engine rooms.

Why did it happen?

- The WT doors were not operated in accordance with manufacturer specifications for minimum closing time. Time from fully opened to fully closed was 7 seconds in one of the accidents, while it was 10 to 13 seconds in the other. The required time is minimum 20 seconds.
- It has been noted from the industry that in some cases crew members do not fully open the WT doors before attempting to pass through the opening.
- In one of the cases the location of the local operating levers for the “accident” door was not optimal. The distance from the edge of the door to one of the levers was 51 cm which required the operator to have a reach of 64 cm to operate the door.

What can we learn?

Personnel should be fully trained in the operation of WT doors. Shortcuts like entering through the door without opening it completely should be avoided. Refresher training in operation of WT doors should be evaluated and implemented.

Checking and adjustment of watertight doors opening and closing time should be included in the ship maintenance program.

Operation levers should be mounted to ensure an optimal operation for the crew. It should be possible to reach both levers when passing through the doors. To avoid mal operations, levers should be standardized as much as possible in accordance with ergonomic principles.

CRANE ACCIDENT – FATALITY (FSI 16)

What happened?

A ship was loading a cargo of steel products using the ship’s cranes. While lifting some coils of steel, the topping lift wire on one of the ship’s crane failed, the crane’s jib then fell and struck the cargo hook block. The bolts securing the crane’s turret to its pedestal then failed and the crane toppled trapping and fatally injuring the crane operator who was in the cabin.

Why did it happen?

- The topping lift wire was in a poor condition and had not been replaced or adequately maintained since the vessel started service.
- Many of the bolts securing the crane’s turret to the pedestal were found to be broken, missing or incorrectly tensioned.
- The vessel did not have the equipment recommended by the manufacturer to correctly tension the crane’s pedestal bolts.

What can we learn?

Crane wires should be carefully maintained in accordance with the manufacturer's recommendations. Topping lift wires should be subject to the same maintenance as the crane's cargo runner wires. Manufacturer's recommendations should be followed with respect to the maintenance of crane pedestal bolts and each ship should have the equipment necessary to perform this maintenance.

FALL FROM HEIGHT (FSI 16)

What happened?

During work on deck, a crew member fell from a height of approximately 7 m from the hatch cover onto the pier. The seaman had been in a lashing passage on hatch 2. Here the hatch cover extends up to the outer side of the vessel.

Why did it happen?

There were no structural measures to prevent falling overboard at this place. The seaman was not wearing any personal fall protection equipment.

What can we learn?

All ship operators, the crews and the safety officers should observe the safety at work requirements against falling resulting from the Accident Prevention Regulations and check observance of these on board their vessels. Above all, permanent safeguards should be fitted at dangerous points. Mobile safeguards or protective equipment against falling are always the poorer means.

It is recommended that the ship operators of similar type ships should consider equipping their vessels with permanently installed ladders at both sides of the lashing passages where needed. This would prevent dangerous climbing onto and descending from the hatch and incorrect use of mobile ladders for leaning.

The ship operators, crews and safety officers should pay greater attention to the technical condition of the mobile ladders on board during their checks. Missing parts should be replaced expertly; heavily corroded ladders should be removed.

FALL FROM HEIGHT (FSI 16)

What happened?

The seaman started work on a catwalk outside the port bridge wing. After a while he fell approximately 24 metres onto the wharf below. He died as a result of the injuries sustained from the fall. He was an experienced seaman who had been inducted in the ship's safety management system and had done this task many times.

Why did it happen?

The harness was not properly attached to the grab rail when the seaman probably lost his footing and fell. The contributing factors to the incident include an inadequate safety harness, the design of the catwalk, an inadequate workplace risk assessment and procedures.

What can we learn?

Shipowners, operators and masters should ensure that safety harnesses and lanyards used by personnel when working aloft are appropriate for the purpose considering all aspects of the tasks to be performed.

Shipowners, operators and masters should ensure that the procedures, permits and risk assessments for personnel working aloft identify all of the hazards and stipulate measures to mitigate all of the risks.

MAN OVERBOARD (FSI 16)

What happened?

While deploying fishing nets, a crew member became caught in the gear and was pulled overboard. The only other crew member on board the vessel hauled the nets up, but recovered only a boot. Search and rescue resources were called and a search for the body of the crew member was unsuccessful. The crew member's body was recovered by another vessel two weeks later.

Why did it happen?

The crew member, who was not wearing a personal flotation device, was working on a deck with limited space.

What can we learn?

Deploying nets can be a high risk operation when working in an area of limited space. Wearing a personal flotation device helps to keep the wearer afloat, thus increasing the ability to survive.

There are numerous types of Personal Floating devices available, having solid buoyancy and manual/automatic self-inflating device. These devices can be cumbersome and bulky and can prevent the wearer from working safely. Floating devices worn by Seafarers should be suitable and fit for purpose when the seafarer is working on a fishing vessel.

KILLED BY THE RELEASE OF CARBON DIOXIDE (FSI 15)

What happened?

While attempting to release a large quantity of high pressure CO₂ to atmosphere, to rectify an earlier error, the resulting reaction from the force of the gas exiting the open unsecured pipe fractured the gas manifold in the CO₂ room. The escaping gas killed all four people within the CO₂ room at that time.

Why did it happen?

The Chief Engineer did not fully understand the Fixed Fire Installation and during maintenance work inadvertently discharged CO₂ from storage cylinders into the discharge manifold where it was trapped.

The Management of the vessel failed to take the opportunity of calling in expert assistance to rectify the original mistake while the vessel was in port and, instead, embarked on a misguided and dangerous attempt to release the trapped gas to atmosphere.

Ship's staff failed to understand the reactive forces occurring when high pressure gases are released from an open pipe/nozzle. Whenever a high pressure fluid – especially a gas – is allowed to discharge through a nozzle the pipe must be adequately restrained from movement.

In the attempts to rectify the situation, the ship was placed in an unsafe condition since the Fixed Fire Installation had been rendered inoperable.

What can we learn?

- Utmost care should be taken when carrying out any maintenance, inspection or testing of CO₂ Fixed Fire Installations. Full instructions must be available and studied before commencing work. Effective training in the maintenance and operation of such systems is essential.
- Maintenance work should only be carried out by fully competent personnel.
- When in doubt – ask.
- If a Fixed Fire Installation is rendered inoperable, the Flag Administration, Classification Society and, in some instances, the Port Authority must be informed immediately.
- The energy content of compressed gases should never be under-estimated.

A FATAL DRY BULK CARGO OPERATION (FSI 15)

What happened?

Three days after a bulk carrier loaded a cargo of DRI Fines, and while the crew were routinely opening cargo hatches to ventilate the cargo, a series of explosions occurred, resulting in the death by injury of the master. Five members of the engineering staff remain missing, presumed dead. The vessel was lost.

Why did it happen?

There was some confusion over the nature of the cargo and the manner it should be cared for during transit. However it was known that there was a possibility that the cargo would give off hydrogen gas if in contact with water and there were instructions from the shippers to open hatch covers if the temperature of the cargo was seen to rise. The accident investigation concluded that an accumulation of hydrogen ignited. The source of ignition was not determined but was most probably from hot spots within the cargo.

What can we learn?

- Vessel's Master and Crew should be properly informed and instructed on the handling of cargoes of doubtful hazard characteristics, such as DRI, and be made aware of all associated hazards. The recognized competent person and the vessels owners and managers should be involved in the loading and transport process. Shipper's certification should be double-checked and records verified ascertaining the pre-loading condition of the cargo; the cargo should be stabilised as far as possible prior to loading.
- Any discrepancy between the instructions on cargo care and monitoring provided by the prospective shipper, the vessel's owner/manager and external guidance such

as the BC Code should be settled to the mutual agreement of all parties and the satisfaction of the Master before commencing loading.

- Special consideration should be given to the potential evolution of hydrogen gas during transport of some cargoes, such as DRI. Also, operators of vessels required to carry bulk cargoes susceptible to exothermic reactions should ensure that suitable and appropriate monitoring equipment, correctly calibrated to a recognized standard, is carried and utilised throughout the loading period and subsequent voyage. Full instructions on the use of the equipment, supplemented if necessary by appropriate training, must be provided. Records of the condition of the cargo should be maintained.

A FATAL TANK CLEANING OPERATION (FSI 15)

What happened?

A chemical tanker caught fire and exploded while the crew was engaged in cleaning residual MTBE from one of several opened cargo tanks, resulting in the loss of the vessel. Only six of 27 crew members survived.

Why did it happen?

The crew opened up the tanks and entered one of them for cleaning before the tanks were fully gas-freed. Opening the tanks exposed the crew to toxic fumes, permitted flammable vapours, that were heavier than air, to accumulate on deck. They diluted the rich atmosphere in the cargo tanks, bringing them into the flammable range. The ignition source could not be precisely determined, but it was noted that one person was in the tank wearing an SCBA. On that occasion it was considered unlikely that metal-to-metal contact from the SCBA and tank surfaces was unlikely to have been the cause, but the practice is not recommended.

Other possible sources of ignition included:

- electrostatic discharge;
- mechanical sparks caused by metal-to-metal contact;
- faulty electrical equipment; hot soot or particles from the funnel; and
- sparks from changing the batteries of portable electrical equipment in a hazardous location.

What can we learn?

- Venting of toxic and flammable gas during gas freeing should be through the vessel's approved gas freeing outlets. No escape of cargo vapours should be possible at deck level (Tanker Safety Guide, Chemicals, ICS).
- If portable ventilation equipment is to be used to blow air into a tank, tank openings should be kept closed until work on that tank is about to commence (Tanker Safety Guide, Chemicals, ICS).
- The extreme hazard of entering cargo tanks for cleaning is emphasized – especially with SCBAs which may themselves give rise to a spark through metal to metal contact. No entry should be allowed until the oxygen level has been confirmed to be sufficient and that there are not any explosives/flammables or toxic gases present.

- Ships' operators and senior officers should properly implement the company and vessel SQES, including referenced documents such as the Cargo and Ballast Operations Manual. Where any such documents leave uncertainty in the minds of the senior officers, clarification and, if necessary, subsequent amendments should be sought; under no circumstances should unapproved tank cleaning operations be undertaken.

LOSS OF LIFE AND PERSONAL INJURY (FSI 12)

What happened?

The Chief Officer and five crewmembers were checking the anchor securing arrangement during a heavy weather passage. The ship began pitching and two waves swept over the bow. One seaman was able to obtain cover from the seas. The Chief Officer and other four crewmembers, who were facing aft at the time, were unaware of the approaching seas. The impact of the waves tossed them from the forecastle to various locations on the forward deck. The Chief Officer and one seaman died as a result of their injuries. The remaining injured seamen were ultimately air lifted to a hospital.

Why did this happen?

The Chief Officer, acting on his own initiative, placed himself and those assisting him in a high risk situation by checking the anchor securing arrangement in heavy weather without first assessing the risks. He did not notify the Master or the Officer of the Watch that personnel would be working on the forecastle deck and they were both unaware of the task being performed. The Chief Officer underestimated the weather conditions and the potential effects on the mission being attempted. He, and the five crew members assisting him, all failed to wear safety harnesses with lifelines.

What can we learn?

Lifelines attached to the railings may have prevented the mariners from being washed from the forecastle deck and could have reduced the extent of the injuries.

It is important to notify the Master and Officer of the Watch when work is being performed on deck, especially during adverse weather.

It is easy for even experienced personnel to underestimate the potential effects that adverse weather may have on the jobs being performed.

What happened?

The Bosun, with the assistance of a Deck Cadet, two Ordinary Seamen, and three Able Bodied Seamen, had just completed changing the cargo wire on No. 2 crane. They worked from 10:00 hours until 17:45 hours with approximately 45 minutes for lunch. The sun set at 16:53 hours and it was getting dark when the job was finished. It was now time to ensure that the wires were running freely. The Bosun, standing on top of a small platform on top of the crane, unclipped his safety belt from the platform rails and directed the Deck Cadet to operate the crane.

The Bosun was unaware that his unclipped safety belt had become entangled with the moving luffing wire of the crane. Moments later he was drawn into the crane between the sheaves and the luffing wire. The crane was stopped and he was freed; however, his leg was nearly severed and he was hemorrhaging. He died of massive traumatic injuries shortly after the paramedics arrived.

Why did it happen?

The Bosun was concentrating on the operation of the renewed cargo wire and he did not notice that his unclipped safety belt had become entangled with the luffing wire. This may have been due to a lapse after the completion of the physically and mentally demanding task of renewing the cargo wire. It is also possible that darkness contributed to the casualty.

What can we learn?

Personnel involved with mentally and/or physically demanding tasks may encounter periods where they have a loss of concentration.

The Bosun might have been more aware of hazards associated with his disconnected safety line if warnings had been given regarding the dangers of loose clothing and personal safety equipment becoming entangled with moving objects.

The onset of darkness changed the working environment and may have contributed to the casualty.

What happened?

While transferring a tow from one ship to another, a crew member was killed by a tugger wire.

The tugger wire was being used to transfer a heavy towing wire from the ship picking up the tow to the towing ship. The tugger wire had been attached to the towing wire, which was lying on the deck of the ship picking up the tow. The deceased crew member was in the process of leading the tugger wire around a towing pin at the stern of the towing ship when the crew of the other vessel dropped the tow wire off their deck prematurely. The tugger wire became rapidly taut under the weight of the towing wire and swept across the deck of the towing ship. The crew member, who was working inside the bight of the tugger wire, was thrown 4-5 m in the air by the wire and then landed heavily on the deck. He sustained serious internal and external injuries and died before he could be evacuated by helicopter.

Why did it happen?

The crew on the ship picking up the tow had fastened the tugger wire to their towing wire prematurely before it had been led around the towing pin on the other ship. There was a failure of communication, which led to the crew releasing the towing wire from their deck in contravention of instructions from their Master. The crew of the towing ship were working inside the bight of the tugger wire and consequently in the path of the sweeping tugger wire.

What can we learn?

Operations involving heavy wires or wires under load are risky and need to be carefully planned and carried out.

All crew involved in these operations need to fully understand the procedure and maintain good communications particularly when there is more than one ship involved.

Do not take unnecessary risks by working inside the bight of a wire or mooring line.

What happened?

While at anchor, the crew of a ship were in the process of removing and stowing tween deck hatch covers. They were using the ship's crane to lift the hatch covers and move them to the stowage position forward of the accommodation. The ship was moving in the sea which was causing the suspended hatch covers to swing. The chief officer placed

himself in a narrow space between a suspended hatch cover and the accommodation's forward bulkhead. The hatch cover began to swing and trapped the chief officer against the accommodation bulkhead. His pelvis was crushed and he sustained serious internal injuries. He died before he could be evacuated by helicopter.

Why did it happen?

It was accepted practice on the ship to conduct the hatch cover operation while the ship was at sea or at anchor and subject to sea motion. There was little consideration of the dangers associated with moving the hatch covers at sea and no instructions from the company regarding the operation. The chief officer had placed himself in the restricted space between the hatch cover and the accommodation bulkhead. He may have been misled by the ease with which the suspended hatch covers could be rotated by hand and thought that he could control the 17 ton hatch cover when it was swinging.

What can we learn?

Operations at sea that involve heavy lifts are risky and should be avoided when the vessel is rolling.

If these operations must be performed, ensure that the suspended weights are adequately restrained from swinging.

Never place yourself in a restricted position adjacent to a suspended weight without leaving a means of escape.

While heavy weights suspended from a single point may be rotated easily, they exert a large force when swinging.

What happened?

While a ship was alongside a jetty in poor weather the Mate fell between the ship and the jetty fenders. The ship had just finished loading and was lying with the top of its bulwarks some 2 m below the jetty deck. The Mate was on deck and was trying to pass some documentation to a person standing on the jetty when he slipped and fell. His pelvis was crushed and he sustained serious internal injuries when the swell caused the ship to close on the fenders. Two crew members, who were working on deck, saw the mate trapped between the ship and the fenders and assisted him back on board. The Mate lost consciousness and died a short time later.

Why did it happen?

There was no safe means of access between the ship and the jetty in the form of a gangway and the ship was moving substantially in the prevailing weather conditions. The relative levels of the jetty and the ship's bulwarks meant that the Mate had to stand on the slippery bulwark and reach up to pass the documentation. He was in a hurry as the weather was getting worse and there was concern that the ship may be damaged by its movement alongside the jetty.

What can we learn?

Ensure that there is a safe method of access between ship and shore when people need to move from one place to the other. Alternatively, ensure a safe method of exchanging documents in all foreseeable conditions when there is no need for people to move between ship and shore.

Always ensure you have adequate handholds when moving about on a moving ship.

Do not take dangerous "short cuts" to save time.

SERIOUS INJURY (FSI 20)

Serious casualty: crew members injured while working on forecastle

What Happened?

A 40,000 gt containership was steaming at reduced speed on a westerly heading in south-westerly monsoonal weather. At about noon, the chief engineer reported to the bridge that the bow thruster water ingress alarm had sounded. Half an hour later the chief officer and five crew members went forward to check on water ingress into the bow thruster room. They found no water in the bow thruster room but found water leaking from the port chain locker into the fore peak store. Two crew members were instructed to pump out the chain locker while the chief officer and three crew members went to the forecastle to investigate the water ingress into the chain locker. They found the spurling pipe cover had shifted, so they replaced it, covered it with canvas and cemented it in place. They then started re-tensioning the loose anchor lashings. While the crew were attending to the anchor lashings, a heavy sea was shipped on deck. The chief mate and two crew members were knocked off their feet and injured. However, one crew member escaped injury and returned to the accommodation to raise the alarm. The injured crew members were recovered, returned to the accommodation and provided with first aid. The master sought tele-medical advice and then diverted the ship to the nearest port of call. The injured crew members were landed there for medical treatment.

Why did it happen?

The crew did not appropriately consider the risks associated with working on the forecastle in the heavy weather conditions. As a result, appropriate risk controls were not put in place.

What can we learn?

- Risk assessments are an essential tool to be used on the job to ensure that all risks are considered and that appropriate risk controls are in place before hazardous work is carried out.

SERIOUS INJURY (FSI 20)

Serious casualty: crush injuries sustained by two crew members in cargo hold

What Happened?

A 6,000 gt ro-ro/lo-lo carrier was en-route in poor weather and the sea/wind state had reached force 8. The chief mate inspected the cargo and reported to the master that there were no problems with the stow. A little later the chief mate was in the mess room when he heard a loud noise from the cargo hold. He went to investigate and found that wooden cradles that were supporting a cargo of steel pipes had moved and that three of the four lashing lines were loose at one end of the pipes. Without informing the master, the chief mate returned to the accommodation and rounded up the crew before returning to the hold to re-stow the pipes. The pipes were stable so the crew climbed on top of them to begin work. However, about 5 minutes later, the ship rolled heavily and the pipes began to move. As a result, both the chief mate and an ordinary seaman had their legs pinned between the pipes. The master was alerted to the incident and a rescue party subsequently removed the injured men from the hold. Both men were evacuated ashore by helicopter, which required an extraordinary effort.

Why did it happen?

No formal risk assessment was carried out before the crew entered the cargo hold to re-secure the lashings, and insufficient risk controls were put in place to ensure the crew members were not injured while they were re-securing the cargo.

The communication between the chief mate and the master was insufficient, not allowing the master to assess the plan to enter the cargo hold with almost all the deck crew and to implement risk controls before the work started.

Among the crew the chief mate, who was of the same nationality as the crew members, was accepted as the authority to give instructions. The master, being the only person of another nationality, was segregated.

What can we learn?

- Formal risk assessments are not a paperwork exercise to appease management but an effective tool to be used on the job to ensure that all risks are considered and that appropriate risk controls are in place before hazardous work is carried out.
- Proper communication in a well understood language is a basic prerequisite to prevent from hazards and to foster safety.
- Attention has to be paid to the matter of national composition of vessel crews taking into account the cultural and language factor.
- Where the ship has a mixed national crew, emphasis must be given to effective communication taking into account both the culture and language factors. This is particularly important in an emergency situation.

SERIOUS INJURY (FSI 20)

Serious casualty: serious injury while stowing the hook and block of a shipboard crane

What happened?

A 14,500 gt, geared container vessel had completed loading refrigerated containers onto its hatch covers, and the crew were attempting to stow the hook and block of one of the ship's cranes whose hoisting system had failed. To achieve this, the hook and block were restrained using slings passed through one of the top lifting eyes of a container on the second tier while the jib was lowered. When the weight had been taken by the slings, and the hook and block were hanging approximately 2m above the deck between two rows of containers, one of the deck officers approached the hook to attach the slings that would be used to drag it forward to its stowage. As the officer approached the hook one of the slings failed allowing the hook to fall on him, injuring him seriously.

Why did it happen?

Although the slings were strong enough to carry the weight of the hook, one failed because it was under tension across a sharp edge that, effectively, cut it into two pieces.

As the crew did not have the knowledge to repair the crane, they were attempting to secure the hook and block using a novel method that had not been thoroughly considered, specifically that the hook was suspended high enough to create a hazard should it fall, that a

member of the crew had to go under the suspended hook to attach another sling and that the weight bearing slings were led over sharp edges.

What can we learn?

- Time spent critically reviewing a plan to determine what could go wrong is seldom wasted. A thorough risk assessment would likely have identified the weaknesses in this plan, all of which would probably have been mitigated with a little thought.

INJURY AND REPORTED MISSING (FSI 19)

Very serious casualty: fire; after spill of highly flammable cargo causing multiple injury and people reported missing

What happened?

An about 4,000 gt chemical tanker in port was discharging highly flammable cargo when some of it leaked on deck. The leaked cargo, which could not be contained because there was also an overflow of ballast water on deck, spilled over the ship's side and was ignited by a launch moored alongside. The launch caught fire and drifted away. The fire spread to the chemical tanker before it was controlled by the ship's crew and a port tug. Several crew members of the launch and the chemical tanker suffered injuries. Three crew members on the launch were reported missing.

Why did it happen?

Crew without proper training and experience in chemical tanker operations resulted in non-compliance with safety regulations and industry best practice. Officers involved lacked competence in critical chemical tanker operations and carried out uncontrolled port operations. Insufficient on board pre-planning and communication of procedures between personnel involved in port operations, inhibited the detection and control of deviations from procedures during port operations.

What can we learn?

- Importance of cleaning/securing cargo spill without delay and of maintaining a "dry tank deck", and avoiding accumulation of water inside the gutter bar.
- Importance of a well pre-planned and well communicated cargo operation.
- Importance of proper competence of the crew when engaged in special trades.

INJURY (FSI 19)

Serious casualty: personal injury with face and neck burns caused by auxiliary boiler explosion

What happened?

While exchanging the auxiliary boiler burner on board an about 39,000 gt bulk carrier at anchor there was a flashback from the boiler furnace. Flames engulfed the ship's engineer, burning his face and neck. The burner was being replaced to rectify misfires.

Why did it happen?

The ship's engineer was not aware of all the hazards associated with maintenance of the boiler burner, i.e. accumulated fuel oil at the furnace bottom resulting from burner misfiring while disconnecting the fuel line from the burner.

The boiler furnace was not sufficiently purged to remove the residual heat in order to avoid ignition of any flammable mixtures.

The ship's crew was not aware of previous flashbacks involving similar burners and the company had not ensured that such safety information was disseminated to the ship's crew.

The boiler manufacturer failed to inform the operators that the boiler burner could be replaced by one fitted with a diesel pilot burner to avoid burner misfires.

What can we learn?

- It is important that all ship's crews involved in the maintenance of boiler burners are aware and have an adequate understanding of all the hazards associated with the maintenance of the boiler burner.
- Information on flashbacks involving similar burners must be brought to the attention of the ship's crew without delay.
- Precautions must be taken to minimize the accumulation of fuel oil at the furnace bottom by avoiding repeated restarts following a burner misfire; it is imperative to sufficiently purge the furnace to remove the flammable mixtures as well as the residual heat.
- All ship crews must be aware of the appropriate first aid treatment required for burn injuries.

INJURY (FSI 19)

Serious casualty: personal injury with broken leg and injuries to the groin caused by windlass hydraulic motor explosion

What happened?

While heaving in the anchor chain of the about 58,000 gt oil tanker anchoring under adverse weather and sea conditions, the windlass' hydraulic motor exploded. Fragments of the hydraulic motor and its casing seriously injured the windlass operator. He was treated at hospital for a broken leg and injuries to his groin.

Why did it happen?

Gross over-pressurization of the windlass hydraulic cylinder block.

Ineffectiveness of the pressure relief valve, plus severely constricted pipes on the outlet side of the relief valve.

Main gear case and oil bath for splash lubrication of the gears had no oil change since installation.

The current industry requirements for windlass machinery failed to protect persons against injury in the event of failure.

The instruction from Master to heave in the anchor chain when it was slack was not followed.

Repeated attempts to heave in the anchor chain, despite its rendering.

Little guidance available on weighing anchor.

Seafarers are not aware of the limitations of the anchor windlass and the potential damage to the machinery when placed under excessive loads.

What can we learn?

- It is important that the pressure parts of the windlass are guarded against potential overpressure, under both instantaneous and continuous conditions.
- It is essential that the industry standards for windlasses are sufficient and adequate to protect persons against injury in the event of the equipment's design limitations being exceeded.
- It is important that clear guidance on weighing anchor is provided and seafarers be made aware of the limitations of anchor windlass systems and the risk of catastrophic failure of the machinery when it is placed under excessive loads.
- It is important that anchor chains are closely monitored when weighing, and that heaving in is stopped as soon as any significant tensioning is observed or any difficulty is experienced.
- It is important that technical data and information for windlass machinery be provided to allow it to be correctly maintained and operated.

INJURY (FSI 19)

Serious casualty: personal injury following explosion

What happened?

There was an explosion in the steering gear compartment of an about 17.00 m fishing vessel. Shortly afterwards a deckhand appeared at the machinery space deck entrance. His overalls were burning. He jumped into the water and was later rescued. He was severely burned and had to be treated in a specialist burn clinic.

Why did it happen?

The deckhand had been preparing surfaces in the steering gear compartment for cleaning by wiping them down with a degreasing agent. Vapour from the cleaning agent was ignited when an automatic diesel oil heater started up.

Ventilation was inadequate for the work undertaken.

An unmarked open canister was found in the engine-room compartment. From the smell it appeared to have contained petrol. This was later confirmed by laboratory analysis. It was said to be used to assist the ignition of the diesel oil-fired heater. While it may not have contributed to the explosion it may well have done so.

Provisions laid down by the national Administration on the use of hazardous agents were not followed.

Personal protective equipment was not worn during the work, i.e. gloves, goggles or respirator.

What can we learn?

- Personal protective equipment necessary for specific jobs should be provided, maintained and utilized.
- The particular hazards of flammable and noxious fumes generated while chemically cleaning should be identified and where possible eliminated, e.g., isolation of electrical sources of ignition and provision of adequate ventilation.
- Volatile liquids such as petroleum should never be left lying around in open containers. If they have to be carried aboard they should be stored securely in accordance with national regulations.

INJURY (FSI 18)

Burns from boiler flashback

What happened?

An engineer was changing the burner on a composite boiler. The ship was steaming slow ahead at the time. There was a flashback and the engineer received burns to his face and hands. Following air purging of the furnace, a second attempt was made to replace the burner. Another flashback occurred causing injury to the chief and second engineers and a fitter who was standing behind the second engineer at the time.

Why did it happen?

- Three attempts were made to ignite the burner, immediately prior to the first flashback, and on each occasion unburned heavy fuel oil would have been deposited in the furnace.
- When the oil firing unit was shut down, there was no flow of air through the furnace until the maintenance cover was removed. The residual heat in the refractory material, and furnace walls, was probably sufficient to vaporize the lighter fractions of the fuel.
- With the main engine running for less than three hours before the incident, it is possible there were still unburned particles of soot, or lubricating oil or fuel passing through the outlet smoke box. The resulting spark could have been enough to ignite the explosive mixture and cause the flashback.
- While sufficient purging of the boiler furnace prior to opening the oil firing unit is a basic safety precaution, in some instances this alone may not be enough to prevent a flashback. If there have been a number of unsuccessful attempts to ignite the burner, liquid fuel may still be lying in the furnace even after a lengthy purge. At these times, it is essential to allow the furnace to cool sufficiently before it is opened.
- Although all precautions need to be taken to prevent a flashback occurring, matters were made worse in this instance because none of the engine-room staff involved in the incident were wearing appropriate personal protective equipment.
- When the injured seafarers were administered first aid, burns ointment was applied to the burns. This is contrary to current medical advice which advocates cooling the burns with copious amounts of cold, clean, fresh water. See for example *A quick guide to first aid/burns*, St John Ambulance, Australia, website – www.stjohn.org.au – as referenced by the casualty investigation report or the UK's, *The Ship Captain's Medical Guide*, website www.mcga.gov.uk
- Contributing to the cause of this incident was the absence on board of important safety information notices issued by the boiler manufacturer following flashbacks which had occurred on other installations and the presence on board of a number of conflicting procedures relevant to boiler burner maintenance.

What can we learn?

- Great care must be taken when working on boiler burner installations – especially, in the case of composite boilers, while the main engine is running. Where instructions have been provided by the manufacturer – either in the way of service bulletins, permanent instruction panels or maintenance manuals – these should be maintained on board the vessel and consulted before maintenance is undertaken.
- The furnace must always be thoroughly purged before any maintenance openings are removed. When no furnace viewing port is provided – as was the case in this instance – an indication that there is unburned fuel present in the furnace can be had by carefully viewing the funnel outlet. Any white smoke would indicate there is still unburned fuel in the furnace or uptakes. A suitable period should be allowed after all signs of smoke have ceased, before opening any maintenance covers.
- Suitable personal protective equipment should be provided by the owner and always worn prior to undertaking maintenance of burner units.
- Guidance on both these aspects can be found in such publications as the UK's Code of Safe Working Practices, which can be downloaded freely from www.mcga.gov.uk. Similar Codes are provided by several Administrations.
- The importance of providing relevant, clear, unambiguous work instructions for all tasks having an element of risk cannot be over-emphasized.

INJURY (FSI 18)

Injury to an eye when an air-flow meter burst

What happened?

The chief officer of a Panamax container vessel suffered injuries to his left eye when an air-flow meter burst while he was conducting annual air quality tests on the vessel's breathing apparatus (BA) compressor. The tests involved blowing air through a glass ampoule for a set length of time. The flow of air was regulated manually using a small regulating valve. Four tests had been completed satisfactorily, but during the fifth test the flow meter burst, sending fragments of glass into the chief officer's left eye. A cadet who was witnessing the evolution escaped injury, but the chief officer was hospitalized for treatment.

Why did it happen?

The accident occurred because the maximum working pressure of the flow meter was exceeded. The working pressure of the BA compressor was 150 bar, but the maximum operating pressure of the flow meter and test device was 10 bar and there was no pressure reduction valve between the compressor and the meter.

There were two types of test device on board, with instructions in different languages, only one of which mentioned using a pressure reduction valve. However, the Chief Officer was unaware of either set of instructions. There were no other instructions or procedures on board for conducting the air test task, and no generic or dynamic risk assessment had been carried out prior to commencing the tests.

What can we learn?

Where a number of components have to be assembled in order to complete a task, there should be procedures or instructions provided to ensure the assembly is correct and the task conducted correctly.

- Always request full instructions and procedures instead of trying to solve a problem locally.
- Where potential hazards exist, in this case high pressure air, a risk assessment should be completed before the activity starts.
- Set an example, always wear the correct Personal Protective Equipment.