

Consolidated Version – Fatalities - Injuries

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.

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 to 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.