

LESSONS LEARNED FOR PRESENTATION TO SEAFARERS (FSI 20)

1 FATALITY

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.

2 FATALITY

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.

3 FATALITY

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.

4 FATALITY

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.

5 FATALITY

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.

6 FATALITY

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.

7 FATALITY

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 be 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.

8 FATALITY

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

What happened?

At about daybreak, a crew member walked through an accessway 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.

9 FATALITY

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.

10 FATALITY

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 girdens of the gantry crane identified that the end stopper hatches located in the protective walls needed to be open. The two crew then immediately went and opened the end stopper hatches. Following that, one crewmember was found struck and killed by the end stop of the starboard aft jib.

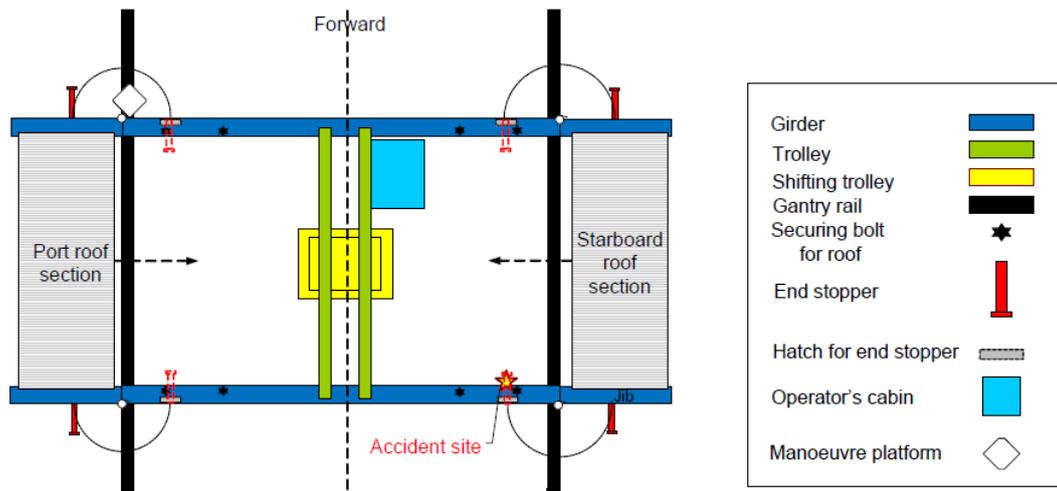


Figure 1: Simplified drawing of the gantry crane seen from above.

Why did it happen?

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

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

What can we learn?

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

11 FATALITY

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

What happened?

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

Why did it happen?

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

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

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

What can we learn?

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

12 FATALITY

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.

13 FATALITY

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.

14 FATALITY

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.

15 FATALITY

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.

16 SERIOUS INJURY

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.

17 SERIOUS INJURY

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.

18 SERIOUS INJURY

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.

19 GROUNDING

Very serious casualty: grounding and subsequent constructive total loss

What happened?

A 100 m long, 4,500 gt modern container feeder ship ran aground on the coast, while trading between a group of islands. The vessel was on her home run serving on a scheduled loop. The grounding occurred at full speed only about 5 nm off her port of call, and in the early morning with an officer on watch standing navigational watch on a six-hour duty turn. Visibility was good, weather and sea rough but with no impact on the casualty. The vessel was salvaged by tug but declared a total loss.

Why did it happen?

Poor bridge team management was identified as having been the root cause of the grounding. The navigational watch pattern was subject to being changed on demand from a standard three-watch system in sea operation – with the master sharing – into a two-watch system – with one watch officer excluded – while serving ports in the islands' inland waters. Thus, the master rotated with the other watch officer on a six hour interval while the first watch officer was released for in-port cargo handling and operation.

This watch system together with other functions allocated to the watchkeepers resulted in an excessive workload for the officer on watch. Fatigue with a resultant deterioration of safety awareness appears to have affected the behaviour of the officer on watch. No look out was posted on the bridge, no regular fixes were taken, no course monitoring was conducted and the watch alarm was switched off.

What can we learn?

- Navigational watch routines have to be planned to accommodate all duties allocated to watchkeepers so that they are not impaired by fatigue.
- Navigational watchkeeping arrangements and principles have to be observed and accomplished in accordance with STCW regulations.
- Regular monitoring of the ship's heading and regular position fixing combined with thorough navigation by eye and the utilization of all available technical aids is a standard professional requirement. Do not switch off alarms.
- The COLREGs and STCW are clear and beyond any doubt. A complete navigational watch team is essential if there is any likelihood of the officer on watch developing stress based fatigue.

20 GROUNDING

Less Serious Marine Casualty: Grounding

What happened?

While on passage on a tidal seaway a 23,000 gt bulk carrier suffered a main engine failure due to fuel starvation.

The order was given to drop both anchors, but they could not be dropped from the housed position without power. The starboard anchor was eventually dropped, but this action was insufficient to prevent the vessel from grounding on the north side of the channel. The vessel

suffered no water ingress, there was no pollution, and after de-ballasting 2,000 tonnes of water the vessel was able to refloat with the aid of two tugs.

Why did it happen?

It was determined that the fuel oil booster pump was drawing fuel (4-6 bar) from the buffer tank to feed the main engine faster than the No.1 fuel oil feed pump was replenishing (2.5 bar) the buffer tank. No.2 fuel oil feed pump did not start, and so the main engine stopped when the fuel oil booster pump was unable to draw suction from the buffer tank. When checked after the accident, No.2 pump also could not produce more than 2.5 bar of pressure.

No.1 fuel oil feed pump was performing poorly due to excessive wear indicating a lack of maintenance. Following the accident it was discovered that there were insufficient spares onboard to repair the pump. No.2 fuel oil pump was on-standby at the time of the accident, but it did not start because the automatic pressure switch was set at 2 bar, and No.1 pump was still producing 2.5 bar of pressure.

Although it did not directly contribute to the accident, the failure of No.2 fuel oil feed pump to build pressure was attributed to incorrect adjustment of the pressure relief valve.

What can we learn?

- Critical systems need to be monitored. In this case, there was no means of alerting the operators to the reducing level of fuel in the buffer tank.
- Critical systems should be included in the vessel's Planned Maintenance System, which should be periodically checked by shore-side technical staff.
- Ship's staff should inform vessel managers when onboard spares need replacing.
- When transiting confined waters, the forward mooring deck should be manned and both anchors should be immediately ready for letting go.

21 COLLISION

Very serious casualty: collision between a fishing vessel and a passenger ship

What happened?

At night and with visibility at about three nautical miles, a 28-metre long, 80 gt wooden-hull passenger ship was proceeding south along the lane of a traffic separation scheme. Approaching from the south was a 44-metre long, 370 gt steel-hulled fishing vessel. As the two vessels approached each other, the fishing vessel having crossed into and proceeding against the direction of the traffic of the southbound lane, failed to manoeuvre to keep well clear of the passenger ship. The passenger ship was participating in the traffic separation scheme. The passenger ship altered hard to starboard, but collided with the fishing vessel which was not fishing. The passenger vessel sank about five minutes later with many persons on board.

Why did it happen?

The fishing vessel did not have on board a chart depicting the traffic separation scheme and failed to keep well clear of the passenger vessel that was participating in the traffic separation scheme.

The passenger vessel did not make the appropriate warning signals with her whistle or light and the evasive action taken was not early enough to avoid the collision.

Both vessels failed to have an effective lookout posted on the bridge.

What can we learn?

- The importance of maintaining an effective lookout at all times.
- When doubt exists as to the action initiated by the give-way vessel, the stand-on vessel should sound warning signals and take such action as is necessary to avert collision, in accordance with COLREGs.

22 COLLISION

Very serious casualty: collision between a fishing vessel and a general cargo ship, and subsequent sinking of the fishing vessel

What happened?

A 6,000 gt general cargo vessel had collided with a fishing vessel in restricted visibility. The fishing boat sank and only two of its seven crew were able to be rescued. The remaining five crew members are missing, presumed dead.

The crew of the cargo ship launched a lifeboat and were able to pick up two of the fishing boat crew, but the lifeboat propeller then became entangled in fishing nets floating in the water. The crew launched a second lifeboat but the engine would not start so further rescue attempts were not possible.

Why did it happen?

Both vessels had operational radar but neither crew were using it to keep a proper lookout.

Neither vessel was sounding a fog signal nor did they have a dedicated lookout.

The general cargo vessel was at full speed and did not have its engine ready for immediate manoeuvring.

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

What can we learn?

- If crew members 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 it is going to be effective in saving lives.
- When a vessel sinks or capsizes flotsam and debris are likely to be floating in the water, particularly when a fishing boat sinks because it almost always has nets and lines on deck that can float free and hinder rescue attempts.

23 COLLISION

Very Serious Marine Casualty: collision between an oil tanker and a small aggregates carrier, and subsequent sinking of the small vessel

What happened?

A 4,000 gt oil/chemical tanker was outbound from a port, travelling at 10 knots in less than 1 mile visibility. It was early morning, and still dark, when the tanker's watchkeeper detected another vessel on radar, 10 degrees on the port bow at a range of 1.5 miles. Three minutes later, the other vessel's mast head and port hand navigation lights were sighted and it was determined that she was on a near reciprocal heading, and would pass port-to-port. The tanker's master altered his vessel's course 10 degrees to starboard to increase the passing distance, and ordered the Aldis lamp be flashed at the other vessel. When the distance between the two vessels had reduced to 1.5 cables, the other vessel altered course to port and was struck by the tanker's bulbous bow. The other vessel, a small aggregates carrier, sank very quickly but fortunately its four crew members were rescued.

Why did it happen?

The main contributing factors were poor visibility, and that both vessels' bridge teams took inadequate actions in these circumstances. There was no proper lookout in poor visibility and the ships were proceeding at too high a speed, given the prevailing visibility. The action taken to avoid a collision was insufficient as to be readily apparent to the other vessel. A too close passing distance was accepted, that left little time to react to a changing situation. It was assumed that the other vessel would also react appropriately. And, eventually, the action taken to avoid the collision did not comply with COLREGs.

What can we learn?

- Masters should not accept passing distances that are too close, as the risk of collision is high if the other vessel fails to react as anticipated.
- Vessels should always react appropriately to restricted visibility. This includes navigating at a safe speed and keeping a good lookout and, once a close-quarters situation is detected, taking the correct actions such as slowing down or taking all way off, and navigating with caution until the other vessel is past and clear.

24 COLLISION

Serious casualty: collision between a Ro-Ro ferry and a sailing yacht

What happened?

A ferry of about 15,000 gt, which operates regularly between two ports, was on a north-easterly course after departing from a port at night, while the yacht of about 20 gt was proceeding under sail on a westerly course crossing the ferry route. It was not until just before the collision that the yacht was identified visually by the ferry. The ferry crew heard the yacht asking an east-bound vessel on VHF if she could see the yacht, but there was no answer and the ferry also had no idea where the yacht was. Suddenly, a high red light was detected at a distance of about 200 metres.

The crew of the yacht observed the departure of the ferry. They thought the ferry would give way to the yacht seeing only her green sidelight and did not realize both vessels were on a collision course until a few seconds before the collision.

The fore section of the port side of the yacht was hit by the bow of the ferry with considerable force. The yacht heeled heavily to starboard and took on a large amount of water, but the crew did not suffer any injuries. There was no environmental pollution.

Why did it happen?

Vessels were coming from both the east and the west. In addition, a drilling platform together with auxiliary vessels was in close proximity to the ferry. The yacht approached the ferry in the shadow of the drilling platform.

It can be assumed that the ferry crew focused primarily on other vessels, and the yacht's tricolour light was apparently overlooked.

The echo of the yacht was hardly distinguishable from radar interference on both the X-band radar and the S-band radar on the ferry, and no attention was paid to the weak echo on the displays. None of the radar settings on the ferry were changed apart from the range.

The yacht gave no information about her own position when asking other vessels on VHF if she could be seen.

What can we learn?

- An effective visual lookout and appropriate radar observations are the best defences against collisions.
- Watchkeeper should never assume they understood another vessels assessment to a possible collision situation.
- Watchkeepers should be aware of the consequential risk of their passing near to large ships.
- The detectability of small vessels would be enhanced by correctly providing information by VHF, AIS or radar reflector.

25 COLLISION

Less serious casualty: collision between a general cargo vessel and a chemical tanker in a traffic lane

What happened?

A general cargo vessel of about 1,800 gt departed a berth at night. When the cargo vessel was entering the fairway, a chemical tanker of about 12,000 gt was sailing along the traffic lane with tug assistance. The chemical tanker attempted to contact the approaching cargo vessel on her starboard side on VHF, but the master of the cargo vessel could not respond to it because of a technical failure with the VHF device. On finding the chemical tanker about 500 m ahead, he set his engine to full astern, but the engine stopped and could not be restarted until it was too late to avoid the collision.

Both vessels suffered only minor damage of dents and scratches. There was no injury to the crew or pollution.

Why did it happen?

The master of the cargo vessel was the only person on the bridge without a dedicated lookout while departing from a very busy port at night even though the vessel was properly manned and procedures were in place as to how the bridge should be staffed upon departure. As the situation developed, he became overwhelmed as he remained focused on attempting to gain back propulsion control.

The pre-departure check on board the cargo vessel under the company SMS manuals was not properly carried out. The VHF was not tested and the malfunction was later found at a critical moment.

The cause of the engine failure could not be found despite a thorough examination of the engine components.

What can we learn?

- Importance of developing a safety culture and raising safety awareness.
- The safety management system must be adhered to at all times.
- The bridge must be properly manned at all times. Arriving or leaving berth is one of several critical operations requiring full safety attention.
- Communication equipment on the bridge should be tested prior to departure.

26 CONTACT

Serious casualty: heavy contact with the linkspan of a ferry terminal

What happened?

A 85 m long, 3,300 gt short sea ferry – with only a few passengers and vehicles loaded – was in process of berthing at a terminal on a routine run. During the approach to the berth, the master, who was conning the vessel from the bridge wing realized that although he had reduced the setting of the combination lever. The starboard pitch was still at full ahead and the ferry was not slowing down. This malfunction of the starboard pitch could not be solved immediately. The engine stopped too late and the executed emergency manoeuvre did not prevent the vessel from making heavy contact with linkspan. There was no warning announcement prior the crash. Both the ferry's bow and the linkspan sustained heavy damage.

Why did it happen?

The malfunction of a vital component of the ship's propulsion system had caused the starboard propeller to remain operating on full ahead pitch with no reaction on the lever setting. The vulnerability of the component involved was known to the engineers on the vessel and shoreside management. The repair history was long. Parts replaced and shortly thereafter adjusted and repaired again only some months prior to the incident were not all original and should have prompted permanent monitoring and control. The failure of the starboard pitch was not fully investigated. A defect report was not issued and system function tests were not part of the operational routine. Long lasting seniority within the ferry company and over familiarization with the vessel had fostered complacency and the deterioration of safety awareness.

A not stringent and conclusive communication between the bridge team and the engine control room has impacted the emergency response.

The impact of the contact could have been mitigated with less speed upon approach.

What can we learn?

- Keep vital operation components under permanent control and function test if their vulnerability is known.
- Review the Safety Management System and make sure that critical defects are assessed, reported and conclusions circulated with the intention to ensure a pre-determined course of action when dealing with these defects.
- If propulsion systems can be controlled and operated from the bridge as well as from the vessel wings make sure that control is properly transferred and command regularly tested.
- Use original and manufacturer's spare parts only.
- Exercise stringent and conclusive language while communicating among each other on command level in general and on emergencies in particular.
- Place particular emphasis on the prevention of complacency during routine and repetitive operations.
- Warning announcements are to be made to alert passengers and crew about forthcoming emergencies.

27 **FOUNDERING AND SINKING**

Very serious casualty: flooding and sinking of a cargo vessel with the loss of 6 lives

What happened?

A 3,500 gt general cargo vessel sailed from a port in an apparently overloaded and unseaworthy condition. The lifeboats' engines were in a dismantled condition. The vessel encountered heavy weather soon after sailing. Due to the poor condition of the main deck, hatches, watertight openings and doors, the vessel began to take on water. On the second day after sailing water was found in No.2 hold. The weather deteriorated further the next day, and further spaces were flooded, including the CO₂ room, chain lockers, forecastle store and paint locker. Holes in the deck allowed water to enter the cargo holds and ballast tanks; the tarpaulin was ripped from the hatch cover by the wind allowing further ingress. The master reversed course and diverted the vessel towards a safe port of shelter. This put the weather on the other (starboard) beam which caused flooding of the engine-room by way of water entering the accommodation. On the evening of the 4th day after sailing the vessel blacked out and lost all propulsion, with the vessel drifting south towards an island. However, the vessel continued to flood and then started to list to port and the master ordered the crew to abandon ship at around midnight. The list prevented the launch of lifeboats, so a liferaft was used. The vessel started to capsize during the abandon ship and all crew jumped overboard with 12 making it into the raft and 7 in the sea. The vessel reportedly sank within 3 minutes. The raft (now reportedly containing only 7 of the original 12 occupants), plus 3 survivors and 3 further bodies were washed ashore on the island. The following day, 2 further survivors were washed ashore. The chief officer was washed ashore on a separate part of the island and remained there, living with locals for almost 3 months until rescued. Sadly, 6 of the original crew of 19 were dead or missing.

Why did it happen?

The watertight integrity of the vessel was compromised. The hull and watertight openings were reported to be in a very poor condition and allowed flooding of the cargo holds and other spaces including the engine-room. The cargo hatch cover tarpaulins failed to remain intact.

The ship was reported overloaded. The master took the vessel to sea in an overloaded and unsafe condition. The combination of overloading and lack of watertight integrity is a recipe for disaster.

The lifeboat engines were reported to be disassembled, although other problems prevented the boats from being launched anyway.

The ship had not been adequately maintained. The Classification Society awarded the vessel certificates of Class implying that the ship was safe to put to sea only one month before the incident. The ship's owners and operator appeared to have no interest in the safety of the vessel or crew.

What can we learn?

- A certificate from a Classification Society is no guarantee of safety of a vessel. The owners must ensure that a vessel is maintained and seaworthy at all times.
- It is essential for the master (as the person on the spot able to take action) to ensure that the vessel is fit and safe to proceed to sea. Once at sea, the safety of life is paramount.

- Life-Saving Appliances is a priority and should be ready for immediate deployment and crew trained in its use.
- Overloading a ship is both illegal and extremely dangerous. The load lines of the vessel are there for the safety of the crew.
- Maintenance of watertight and weathertight closures are critical. They should always be kept in good working condition.

28 SINKING

Very Serious Casualty: tug sank while moored alongside bunker barge

What Happened?

A bunker barge and its pusher were made fast alongside a tanker. The tug was moored alongside the barge with a bow line, a forward spring and an aft spring. The skipper shut down the tug's engine and then went on board the tanker to prepare for bunker transfer. The tanker, and hence the tug and the barge, was lying with its bow facing into the 3 to 4 knot current of tide.

Half-an-hour after the bunker transfer started, the tug skipper noticed that the tug was inclining to port and that water was entering the main deck. Water continued to enter the main deck and soon started flooding through open port holes. The bunker transfer was stopped and the bunker hoses had been disconnected. 30 minutes later the tug sank.

Why did it happen?

The force of the 3 to 4 knot tide acted on the bow of the tug, opening the distance to the barge. As the tug's bow moved away from the barge, the tug heeled to port. Eventually, the tug heeled to the point where water entered the main deck. The tug continued to heel to port and water then started entering through open port holes on the vessel's port side. The ingress of water eventually resulted in the tug sinking.

What can we learn?

- A vessel should be moored in such a way that prevents the bow opening, presenting a wedge to an oncoming tidal flow.
- A vessel's watertight integrity should be maintained at all times.

29 FIRE AND SINKING

Very serious casualty: fire on board a fishing vessel, leading to sinking

What happened?

A 3,500 gt, 90 metre long, 34-year-old steel fishing vessel sailed from port following a post lay-up refit. During the refit various electrical cabling within the vessel and on deck was replaced. However due to time pressure to sail from the repair yard, replacement of cabling to the lighting within the fish storage tanks was not carried out (despite requests from the chief engineer - blackening of the cables was visible). No close-up visual inspection was done due to the height of the cabling from the deck (2.9 metres), however operation and insulation checks were done. Three days after sailing a fire broke out in a fluorescent light in an empty crew cabin; the fire was quickly detected and extinguished using a portable extinguisher. The captain, aware of the hazards posed by the shortcomings of some of the electrical systems, initiated enhanced fire patrols every 2 hours; the fish storage tanks were

not included in these rounds. 4 days after the first fire, a fire broke out in fish storage tank 2. At the time the tank contained 20,000 paper fish-boxes and 50,000 paper bags, plus 105 two hundred litre drums of oil. The bags and boxes were stacked to within 20cm of the deckhead. Attempts were made to extinguish the fire using fire hoses, but due to a blocked drain line from the fish hold, water built up in the space causing the vessel to list. The master ordered the crew to try to extinguish the fire by suffocation. However gaps around the main hatch allowed air to enter the hold despite efforts to block the gap with blankets etc. A day later the space was opened and further unsuccessful attempts were made to extinguish the fire with water, so the hatch was closed again. 3 days after the start of the fire another unsuccessful attempt was made to enter the hold and put out the fire. Unfortunately on this occasion the fire spread rapidly out of control and the Master requested a nearby fishing vessel for assistance and the crew abandoned the vessel. The vessel became engulfed in fire and sank on the same day. There was no loss of life, seven crew members suffered the effects of toxic smoke inhalation. All were rescued by the second fishing vessel.

Why did it happen?

It is strongly suspected that a short circuit in the cabling in the fish hold caused an electrical fire which ignited the combustible contents of the hold. It was noted that the no fuse breaker (NFB) had failed to trip.

The fire was detected after it had already taken hold. Attempts to extinguish the fire with water were frustrated as this affected the stability of the vessel due to blocked drain lines. The hatches to the fish hold could not be sealed in order to suffocate the fire due to inadequate maintenance.

The ship sailed from the repair yard without completing work on the electrical cabling. The cabling was 34 years old. The NFB failed to cut the power to the cabling. Fire rounds did not include the fish hold.

What can we learn?

- Electrical cabling identified by visual inspection and subsequent testing to be below the required performance specification should be replaced at the earliest opportunity; meanwhile the faulty circuit should be isolated.
- When fighting a fire by suffocation, the space should remain sealed until it is sure that the fire is out.
- Fire rounds and fire protection systems must cover all areas of the ship.
- Electrical safety devices, such as NFBs must be maintained and tested regularly.

30 FIRE

Serious casualty: engine-room fire

What happened?

A 45,000 gt containership's No.4 diesel generator (DG4) suffered a catastrophic failure, disabling the generator and starting a fire. The engine-room was evacuated and the ship's fixed carbon dioxide (CO₂) fire extinguishing system was operated. The decision to use the CO₂ system was prudent, and together with the prompt use of the ship's fire dampers, remote valves and emergency stops reduced the severity of the damage to the generator room.

Why did it happen?

It is possible that one or more of the connecting rod palm nuts or counterweight nuts had not been sufficiently tightened (or overtightened) during recent overhauls and that the resultant failure of one of the retaining studs was the initiator of the catastrophic engine failure.

What can we learn?

- It is important to make reference to the engine manufacturer's recommendations when tightening the nuts for the connecting rods or counterweights, and in using the appropriate and calibrated tools, e.g. torque wrench and/or hydraulic tightening devices.

31 FIRE

Serious casualty: fire in the auxiliary engine-room

What happened?

On a 32,000 gt ro-ro passenger ferry a fire broke out in the auxiliary engine-room (AER). The seat of the fire was in way of the auxiliary engines' fuel supply module and quickly spread across the compartment. The fire was eventually extinguished by the ship's crew. There were no passengers on board and none of the ship's crew was injured. However, the fire caused the vessel to lose electrical power, which ultimately required her to be towed back into port for repairs.

Why did it happen?

Fuel oil escaped under pressure from the auxiliary engine fuel module pressure regulating valve actuator and came into contact with an exposed high-temperature surface on the adjacent auxiliary engine. The auxiliary engine fuel oil module excess pressure regulating valve actuator diaphragm perished and ruptured because it had been manufactured from a non-oil resistant rubber. The fire could not be contained within the AER because heat from the fire was conducted through an un-insulated section of the fire boundary to electric cables on the deck above. Several spaces above the AER were incorrectly classified at build and were not protected by thermal insulation in accordance with SOLAS requirements.

The performance of the local water-mist system was adversely affected by a delay in activating the system, the inadequate production of water-mist, interruptions to the supply of water-mist, a reduced duration of operation and/or the insufficient water-mist coverage above the seat of the fire. The machinery space high-expansion foam fixed fire-extinguishing system was fully discharged into the AER, but failed to produce any foam because its discharge nozzles were clogged with rust from the internal corrosion of the dry pipe distribution network. The high-expansion foam system distribution pipe network was fabricated from mild steel and was not self-draining, therefore it was extremely susceptible to corrosion.

The fire-fighting effort was impeded by the intermittent loss of fire main pressure due to the emergency pump control cables within the AER being damaged by the fire.

What can we learn?

- The fuel oil changeover procedure must be understood by the ship's engineers in charge of the operation; and the harmful effects of closing any valves in isolating the excess pressure regulating valve or prevent fuel returning to the service tanks must be fully understood by all.

- The exhaust lagging or heat shields must be properly replaced after carrying out any work on the main or auxiliary engines.
- It is important that the dry pipe distribution network and the discharge nozzles for use in high expansion foam fixed fire extinguishing system is properly maintained to avoid blockage or clogged with rust resulting from corrosion of the dry pipe.
- It is essential that crews are aware of the location of the ventilation system fire dampers and be provided with onboard guidance.
- It is essential to maintain an effective fire fighting command and control efforts in an emergency situation with adequate knowledge of the fixed fire-extinguishing system, and having good radiocommunication voice procedures.
- It is essential that excess pressure regulating valves for use with fuel oil systems are fitted with appropriate rubber diaphragm suitable for use with fuel oil and incorporated with leakage glands and rupture indicators.
- It is important to be aware of the potential problems associated with the use of low sulphur fuels, e.g. poor lubricating characteristics; undesirable additives or blend components; cleaning action or searching nature which can lead to clogging and increased leakage.
- It is essential that thermal insulation be provided with due regard to the fire risk of the spaces and adjacent spaces in accordance with SOLAS requirements.
- It is important for the manufacturer/shipowner/ship's engineer/surveyor to ensure the performance and effective functioning of water-mist systems, to ensure prompt activation of the system; adequate production of the water-mist; un-interrupt supply of water-mist; endurance of operation and sufficient water-mist coverage above the seat of fire.
- It is essential that the distribution pipe network of high-expansion foam system is fabricated from corrosion free materials and the pipe layout be provided with self draining features.
- It is important to ensure the continuous supply of power to the emergency fire pump. If there is a possibility that the power supply be cut off or damaged by fire, an independent power should be considered, e.g. driven by an independent diesel engine.
- It is important that crews are aware of the hazards to personnel in compartments containing high-expansion foam.
- It is important that decent surveys and tests are properly carried out on high expansion foam systems in accordance with the manufacturers' instructions and current IMO guidelines, which includes blowing through with compressed air, to guarantee the reliability of these safety critical systems.
- It is important to ensure and verify that foam flooding systems are charged with the appropriate type and quantity of foam concentrate.
- It is important that fixed fire-extinguishing systems be maintained in accordance with the manufacturers' instructions and/or the ship's planned maintenance system schedules.
- It may be useful for ships to have its own operating procedure or policy for its high-expansion foam fire-extinguishing system.

32 FIRE

Serious casualty: Electrical fire inside cargo hold

What happened?

When a 18 gt cargo ship was sailing in coastal waters, the crew smelled burning plastic. When the crew opened the hatch of the cargo hold to check it, a flame of approximately half a meter appeared and dense smoke came out for approximately 15 seconds. The fire was extinguished in a few minutes by a crew member using two portable dry powder fire extinguishers.

The fire broke out in a fluorescent tube fixture placed on a niche panel in the cargo hold. Six passengers were transferred to another company's vessel. There was only minor damage to the cargo hold after the fire and the ship was able to continue the voyage.

Why did it happen?

The fire was caused by electric arcing in the sockets of the fixture for fluorescent tubes. The fluorescent tube fixtures had poor mechanical/electric connection between socket and tube, and without having open circuit and short circuit protection, presented a potential risk of causing a fire on ships that are moving and vibrating. The fluorescent tubes did not fulfil the requirements for preventing overheating causing damaging of cables and surrounding material.

What can we learn?

- Fluorescent tube fixtures used on board ships should fulfil guidelines and certain standards and be marked accordingly, allowing the user to choose the right equipment and discard the unsuitable.

33 EXPLOSION

Serious casualty: explosion within a ballast tank during hot work

What happened?

A 28,000 gt geared forest product carrier was undergoing repairs in a repair yard. At the time of the incident (late evening), hot work was ongoing within No.2 port ballast tank. Sections of the shell plating were being replaced. Gas cutting of steel plate was ongoing using liquefied petroleum gas (LPG) (in place of acetylene) and oxygen gas cutting equipment. Welding equipment was also in use. An explosion occurred within the tank, killing 2 shipyard workers and injuring seven others; three shipyard workers ended up in the water and were rescued by a shipyard boat. No members of the ship's crew were within the tank or injured.

Why did it happen?

Gas cutting equipment had been left in the tank for a prolonged period. Several gas cutters were in the tank and had their gas valves opened up and left on throughout the whole day in question. It is suspected that leakage from the various gas cutters led to an accumulation of LPG in the bottom of the ballast tank. The explosion occurred late in the evening, probably caused by sparks dropping from the hot work to the bottom of the tank.

The ventilation fans fitted to the tank had insufficient power to propel air to the bottom of the tank and therefore did not dispel the gas from the tank.

Gas tests were only made prior to the work starting in the morning – no follow-up gas tests were made during the day at shift change or after breaks, hence the leaking gas was not detected.

What can we learn?

- Ventilation needs to be sufficiently powerful to circulate fresh air around the entire tank – the use of trunking to take air to the bottom of the tank is essential.
- Gas tests must be made at frequent regular intervals during the day, and after any break. Gas tests should be made at all levels within the tank.
- Any gas equipment, when not in use, should be isolated and removed from the tank.
