9

Injury

9.1 Fatal fall from ladder

Two stevedores were in the cargo hold finishing their job. It was morning, and having started their shift the previous evening, they had been working for more than 12 hours. To exit the cargo hold they had to first climb up a vertical ladder, then ascend a spiral staircase and for the last 2.5 metres climb up another vertical ladder.

The stevedores had brought a thermos and tea cup each. The cup did not fit in the first stevedore's boiler suit pocket so he held it in his hand instead. This wasn't a problem when he ascended the spiral staircase. However, when he reached the last platform there was still the vertical ladder to climb up.

20 metre fall

Climbing up the last ladder he only used one hand as he had the tea cup in the other. He was not wearing a safety harness. When he was almost at the top he slipped and fell down. Unfortunately, he did not hit the platform below but fell more than 20 metres and landed at the bottom of the cargo hold.

The other stevedore shouted for help which the bosun heard. He could see the stevedore lying at the bottom of the cargo hold and instantly called the Chief Officer on the radio and told him about the accident. The Chief Officer assembled a rescue team with a stretcher and gave the stevedore first aid. An ambulance arrived shortly afterwards and he was lifted out of the cargo hold by a crane. Unfortunately, he was declared dead at the hospital.

Damaged ladder

It was later found that a steel bar was missing from one of the lower railings at the beginning of the spiral ladder. The railing was most likely damaged during the loading by one of the crane grabs, or an excavator as it was covered by the cargo when it arrived at the discharge port.

What can we learn?

- The definition of 'working at height' should be addressed in the risk assessment, in addition to details of the safety measures that need to be taken.
- In the risk assessment it should state whether the specific job requires a work permit.
- It is up to every company to define if they consider it an acceptable risk to enter the cargo hold on a vertical ladder without a safety harness attached.
- In this specific case the person climbing the ladder only used one hand and had no safety harness. The problem here is how the stevedore perceived the risk at the time.
- Most of us would agree that it is safer to use both hands when climbing a ladder. However, when climbing ladders is a daily occurrence it is easy to forget that the consequences of slipping can be fatal. Advice from the Code of Safe Working Practices (COSWP) states that when climbing a ladder three points (foot or hands) should always be in contact with the ladder. When the consequences of falling from that ladder are so severe, a harness should really be used.
- It would be beneficial to have a toolbox meeting with the stevedores' supervisors to explain what is required of the stevedores when working on board.
- It is understood that many ports require that stevedores wear a safety harness when climbing the cargo ladder. It is important that the Chief Officer emphasises the importance of complying with this requirement.
- After both loading and discharging, the Chief Officer should inspect the ladders to ensure they have not been damaged during the cargo operation.
- This accident highlights the minimal effort it takes to do a job safely, and the consequences of not making that effort.

9.2 Lost balance while washing down caused serious injury

A bulk carrier was in port and one of the ABs was washing the hatch coaming gutter. He had connected a fire hose to a fire hydrant and was spraying water. The cargo hatch covers were open and the AB was wearing a safety harness.

Unclipped safety harness

The harness became tangled with the fire hose and so the AB briefly unhooked it so he could untangle the safety cord. At the same time the pressure in the hose changed causing the AB to lose his balance and fall 16 metres down into the cargo hold.

First aid was given to the AB by the crew and the Master called for an ambulance. Unfortunately, he did not recover and died at the hospital.

What can we learn?

- Working aloft is a high-risk operation and all vessels have procedures on how to do so safely. It is a requirement to fill out both a risk assessment and a work permit for any job in this category. The risk assessment and COSWP requires that all risks should be evaluated and that the harness should be connected at all times.
- The AB in this case was wearing a safety harness, but at the time of the accident had it unhooked at the same time as he lost his balance. This highlights once again that it only takes one second to make a fatal mistake.
- If two persons had been assigned for this job it would have meant that the AB could work on his assigned task by washing down and the other AB could assist with the hose.
- Working at sea is by default a dangerous job and the crew is often involved in high risk operations e.g. working aloft, mooring, securing cargo and other operations. A case like this highlights that a decision to unhook the safety harness when at the same time holding a pressurised fire hose can lead to a fatal fall.
- Everybody looks on risk differently – that is why it is so important that the safety department ensures the crew is trained in evaluating and understanding risks, and the potentially fatal consequences of forgetting this.

9.3 Injury during mooring operation

It was early morning with no wind or currents and a vessel was approaching port. On the stern an AB was preparing the mooring ropes. The stern lines were put partly around a bollard with a bight at a right angle to the normal pull direction. After the AB had prepared the mooring lines, the Third Officer joined him. The spring lines were sent ashore and made fast, and the Master, who was on the bridge, put the engine pitch to zero allowing the vessel a slight forward movement. The rudder was hard to starboard as the vessel was berthing port side alongside. After the spring lines were secured the heaving line was connected to both stern lines.

The Chief Officer, who had been by the manifold, came to the stern to assist and took charge of the mooring winch. The Third Officer walked to the stern railing by the fairlead.

Mooring commences

The linesmen shouted that they were ready to receive the stern lines, so the AB started to lower the stern lines to the water. He was facing the mooring winch and had his back to the Third Officer by the railing. He let the mooring lines run out at a very high speed. Suddenly the Third Officer started to scream and when the AB turned around he could see the Third Officer caught between the mooring line and the fairlead. The mooring line was now coming out very quickly and began cutting into the Third Officer's leg, with such a speed that his leg was cut off just below the knee.

Mooring rope stuck in propeller

The Chief Officer saw that the mooring rope was stuck in the propeller and screamed over the VHF to the Master to stop the engine. The Master pushed the emergency stop and the propeller stopped.

The Third Officer was in severe shock and collapsed. The Chief Officer ran over to give first aid and the gangway was rigged. A first aid team from shoreside came on board, and 30 minutes later an ambulance arrived and took the Third Officer to hospital.

Life changing consequences

The Third Officer survived, but is now disabled and can never work at sea again.

What can we learn?

- The vessel had a risk assessment for the mooring operation, but this did not include the risk of the mooring line getting stuck in the propeller, as the mooring line should be floating in normal circumstances. This time the mooring line was lowered too quickly, ending up under the surface. As the propeller blades were only 2 metres below the surface the lines were sucked into the propeller, which caused the accident.

- In addition the mooring line was partly around the bollard, with a bight and a right angle to the normal pull direction. This arrangement caused the snapback zone to cover the entire area between the bollard and railing. When the rope ran out rapidly and got caught in the propeller it snapped back to where the Third Officer was standing, even though he was not inside the normal snapback zone.

- This shows the importance of everybody involved in the operation being aware of the risks of potential snap back zones. Mooring a vessel is a normal operation, but the risks need to be evaluated every time, as it is a risk operation.

9.4 Fatal fall

The oil tanker was berthed alongside and discharging cargo. The Chief Officer was signing off the same day, and as his replacement had been sailing on the vessel for many years they carried out a quick handover.

Tank cleaning

The following morning the cargo operation was completed around noon and the crew began to clean the cargo tanks. The Chief Officer oversaw the tank cleaning operation and gave orders to the Second Officer in the control room and two ABs who were cleaning the tank on deck. One AB worked in the deck trunk and the other was handling and monitoring the tank cleaning machinery on the tank deck.

Supervision

The Chief Officer's responsibility was to ensure that the tank cleaning was carried out safely and that the tanks were cleaned properly. He visually checked that the tanks were clean. He checked each of the tanks by taking a couple of steps down the tank access ladder and looking down the tank while lighting it up with a flashlight. While doing so, he did not wear a fall arrest harness. As the ABs and the Second Officer were busy carrying out their own tasks, none of them noticed whether the Chief Officer had measured the levels of oxygen and toxic gases in the tank atmosphere before he began to visually check the tanks.

Fall into tank

After a while the OOW in the cargo control room noticed that the Chief Officer was not answering his radio; so he asked one of the ABs to search for him. When the AB looked down into one of the tanks from the hatch opening, he spotted the reflective striping on the Chief Officer's boiler suit at the bottom of the tank near the end of the ladder.

The Master was informed and hurried to the tank, ordering the crew at the scene to fetch a stretcher, oxygen kit, and breathing apparatus. The Master put on the breathing apparatus and entered the tank.

He found the Chief Officer severely injured and unconscious. The Master fastened a harness onto the Chief Officer, and the crew on deck hoisted him up. First aid was immediately given, and the Second Officer contacted the terminal asking them to call the emergency coordination centre.

Tank atmosphere

One hour after the Chief Officer had been evacuated, the Master monitored the atmosphere in the tank. The gas monitor went up to its maximum 100ppm of hydrogen sulphide content. It is unknown if this made the Chief Officer unconscious.

The ambulance arrived and its crew tried to resuscitate the Chief Officer. Ten minutes later he was pronounced dead. He had fallen from a height of 10 metres.

What can we learn?

- The Chief officer was not wearing a fall arrestor while climbing down the ladder. There is a reason this is a requirement as the consequences of failing to wear one can be fatal, as in this tragic case.

- A cargo hold is an enclosed space and it is essential that the company has efficient procedures on the requirements of testing the atmosphere before entry into every tank.

- Chapter 15 of the Code of Safe Working Practices (COSWP) provides excellent advice on how this should be done safely and says:

  'The presence of certain gases and vapours requires specialised equipment and trained personnel to undertake accurate and reliable testing. If this equipment is not available for use, the period of gas freeing should be considerably extended.'

  It seems that the Chief Officer did not follow the testing procedures for the atmosphere, as the tank had the maximum ppm of hydrogen sulphide.

- COSWP Chapter 17 'Work At Height' provides the following definition:

  '17.1.1 Anyone working in a location where there is a risk of falling may be regarded as working at height. In addition to work on ladders, staging and scaffolding, this includes undertaking work inside a tank, near an opening such as a hatch, or on a fixed stairway.'

  '17.1.2 Work at height should be subject to risk assessment, and suitable control measures should be taken to protect those who may be put at risk. Depending on the severity of the risk, a permit to work may be required (e.g. for working aloft).'

- The company should review and see if work permits, and risk assessments must be updated.

- The company should ensure that all crew members understand the importance of using correct PPE, and especially the harness and fall absorber, when entering a tank or cargo hold.

9.5 Rescue boat accident

The vessel was lying alongside at the first port of call since it had left dry dock. The Master wanted to carry out a man overboard drill, as the weather was favourable. He told the Chief Officer to have the rescue boat ready after lunch.

Repairs

The davit wire for the rescue boat had been replaced while in dry dock and the Master wanted to carry out the drill to ensure that all was in order. Before going to dry dock the Chief Officer had ordered a new wire. In fact the wire he received was of a smaller diameter, but he assumed that as it was only 2 mm smaller than the original this would not be a problem. He did not double check this assumption and was unaware that the davit winch motor was too strong for the davit wire.

Whilst in dry dock an electrician had replaced the fuse in the circuit board of the davit winch motor. He had replaced the original fuse with a much higher amperage fuse.

Successful launch

After lunch the rescue boat crew proceeded to the launching area. The Second Officer held a briefing with the rescue boat crew and all others involved. The rescue boat crew included the Second Officer and two ABs. The bosun was in charge of the davit winch and the Chief Officer was monitoring from the deck. The Master was monitoring from the bridge.

The crew boarded the rescue boat in the stowed position. They were wearing the correct safety equipment and safety harnesses, which they secured to the rescue boat to prevent them from falling overboard. The bosun started to lower the boat at slow speed, and when the davit was fully extended he then increased to high speed.

The rescue boat's engine was started just before the rescue boat hit the water and the hook was released when the boat was in the water. The drill was uneventful, and the boat returned to the hook to be hoisted back into position. The bosun raised the boat at high speed and when it was near the main deck he switched to slow speed. The crew did not disembark on the main deck, as the plan was to disembark when the boat was in the stowed position.

Successful launch

The bosun continued to hoist the boat at slow speed to the stowed position, expecting that the proximity switch would shut down the motor before the davit arm made contact with the structure. This did not happen, and the motor applied even more power.

This sudden increase in power caused the wire to break and the boat to fall more than 20 metres into the water, taking the crew members with it.

One of the crew members was stuck in his safety harness underneath the boat and drowned. The other two crew members were seriously injured.

Successful launch

It transpires that the electronic proximity switch was not working because moisture had penetrated the electronics. This happened when the rescue boat was washed down using the high-pressure hose - the proximity switch's electronic cover was also washed down and moisture entered the system causing a short circuit.

According to the vessel's SMS, the crew should always check that the proximity switch is working before they use the rescue boat. The proximity switch was not tested.

What can we learn?

- The proximity switch is intended to cut power to the winch motor when the boat is close to being in the stowed position. This is an emergency device to ensure that the winch motor does not put too much stress on the davit wire. It is essential for preventing possible catastrophic failure. The davit had only one proximity switch so there was no back-up.
- The crew should not embark or disembark the rescue boat when it is in the stowed position. They should board when the rescue boat is in a secured position on deck.
- The amount of people being injured or even suffering fatal injuries is a major concern. To prevent serious injury it is essential that all crew understand how the davit system works and that all equipment is in good condition. Ignoring the correct procedures could lead to fatalities.
- The over-compensation by the winch motor causing the wire to break may have been prevented if the correct fuse had been in place.
- According to the manufacturer's manual, the winch operator should stop the winch before the proximity switch is activated. There were no marks on the davit to indicate to the operator when to stop.

9.6 Severely burned crew member died

The oil tanker was in port loading when it was discovered that a valve was leaking in the pump room, so loading had to be stopped. Because of the leakage the pump room was full of explosive gas. The Master informed the terminal that loading had to be stopped.

Ventilation

The Master updated the Superintendent, who advised the Master to ventilate the pump room. It was decided that the cargo that was still in the lines should be put in the slop tank.

The broken valve was in a difficult position as it was close to the bulkhead. The crew could not fix this with their tools, so a contractor was arranged to come on board and carry out the repairs. The Superintendent decided that the vessel should depart for the next port for loading where the contractor would embark.

The crew began to ventilate the vessel. When the gas in the pump room was below 1% LEL (Lower Explosive Limit) the crew started to wash down the pump room and lowered a portable water pump into the room to pump out the water. When this was completed, a hydraulic water powered fan was put in the pump room to dry it out and the crew started to clean up the leaked cargo.

Later that evening the Chief Officer was resting before arrival in the next port. The Master had taken the Chief Officer's watch to let him rest, as the schedule was tight, and the crew would not get much rest before arrival.

Fans in pump room

The fans in the pump room had to be moved so they could dry out the entire room before arrival. The AB on the watch did not want to wake up the Chief Officer and bosun to move the fans so he went to the engine workshop and found an electric portable fan which was lighter to manoeuvre. He put it in the pump room for ventilation.

Combustion

After an hour or so he came to move the fan into one of the corners which was not completely dry. When he plugged it in there were sparks and these ignited the combustible gas which was in a pocket of the corner. The gases severely burned the AB who managed to run out of the pump room to the emergency shower and extinguished himself. The Master could see this from the bridge and activated the general alarm. The AB was taken into the vessel's hospital and given treatment. The Master contacted medical assistance and proceeded with full speed to the nearest port. The coast guard despatched a large rescue boat cutter to pick up the AB.

The AB was taken to hospital with severe burns. After several months of treatment, unfortunately he died.

What can we learn?

- The Code of Safe Working Practices (COSWP) has excellent information under 'Testing for toxic gases' and states:

  'The presence of certain gases and vapours requires specialised equipment and trained personnel to undertake accurate and reliable testing. If this equipment is not available for use, the period of gas freeing should be considerably extended.'

  It seems that the crew had tested the atmosphere in the pump room but for some reason had missed the pocket of gas that exploded. This emphasises the importance that the company ensures that correct testing equipment is on board and that all crew members involved have been trained correctly.

- There should be proper training on which fans are allowed when toxic gases need to be ventilated. This should be included in the SMS.

- The company should continually review whether any work permits and risk assessments should be updated.

- The pump room had most likely become an enclosed space because of the toxic gas. If we once again refer to COSWP, Chapter 15.1.5 states:

  'A dangerous space may not necessarily be enclosed on all sides, e.g. ships' holds may have open tops but the nature of the cargo makes the atmosphere in the lower hold dangerous. Such places are not usually considered to be dangerous spaces, but the atmosphere may become dangerous because of a change in the condition inside or in the degree of enclosure or confinement. Personnel need to exercise caution before entering any space on board a ship that has not been opened for some time. Examples of such spaces are cargo pump rooms.'

- The company should ensure that the procedures regarding enclosed space entry are up to date and address the issues that led to this tragic accident.

Glossary of common industry abbreviations

Term	Meaning
AB	Able seaman
AIS	Automatic identification system
ARPA	Automatic radar plotting aid
COLREGS	International Regulations for Preventing Collisions at Sea
COSWP	Code of Safe Working Practices for Merchant Seafarers
CPA	Closest point of approach
CSM	Cargo securing manual
ECDIS	Electronic chart display information system
ETA	Estimated time of arrival
GM	Metacentric height
GPS	Global positioning system
IHO	International Hydrographic Organization
IMDG Code	International Maritime Dangerous Goods Code
IMO	International Maritime Organization
IMSBC Code	International Maritime Solid Bulk Cargoes Code
ISM	International Safety Management Code
JRCC	Joint rescue coordination centre
MOU	Memorandum of understanding
NM	Nautical miles
OOW	Officer on watch
PA	Public address system
PMS	Planned maintenance system
SMS	Safety management system
SSAS	Ship security alert system
SSP	Ship security plan
STS	Ship-to-ship (transfer)
TML	Transportable moisture limit
UHF	Ultra high frequency (radio)
VDR	Voyage data recorder
VHF	Very high frequency (radio)
VTS	Vessel traffic serice

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