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MARS 201025
Fined for suspected discharge of sewage

During port stay, the sewage treatment plant high-level alarm sounded. The duty engineer opened the overboard valve to prevent the system from potentially overflowing into the engine room bilges. Subsequently, during a PSC inspection, the PSC official noted this open valve, which was in contravention of local regulations and imposed a penalty on the vessel. There was no evidence to indicate that treated sewage had been discharged overboard; however, a potential for sewage pollution was present due to the open overboard valve.

Investigation into the incident also revealed that while the unit was being cleaned earlier in the month, some solid non-biodegradable items were found in it. The high-level alarm was tested and found to be in good operational condition. On the date of the incident, it was suspected that the sewage pump impeller had become blocked with debris, causing the build-up of effluent in the system.

Root cause/contributory factors

1. Non-compliance with company instructions with regard to sewage discharge valve to be kept locked in certain regions to comply with local regulations;

2. Non-compliance with chief engineer's standing orders and local port authority regulations;

3. Lack of a locking device on valve so as to prevent unauthorised opening of valve in port.

Corrective/preventative actions

1. Pre-planning meeting is to be held with all officers and engineers prior to entry into port in order to make them aware of all local regulations as advised by local agents, or on the basis of information received from all available sources on board.

2. All vessels to ensure that a locking arrangement is fitted on the overboard valve so as to positively lock the valves in the shut position while in port.

3. Appropriate signage to be placed near the sewage overboard valves explicitly prohibiting discharge of sewage while in port limits.

■ **Editor's note:** The fact that some non-biodegradable debris had been sighted in the system during previous maintenance and the suspicion that this may have accumulated and affected the efficiency of the sewage treatment plant suggests improper fault-tracing and ineffective corrective maintenance. Under Marpol regulations, vessels with faulty pollution prevention/control systems or related deficiencies must report the situation to the nearest coastal state immediately on such fault(s) being discovered.

MARS 201026
Finger partly amputated

A leak was observed from the fresh water (FW) generator from the vacuum drum cover gasket about a month prior to the incident in question. Appropriate spares had been ordered in advance but there was a delay in their delivery. In the meanwhile, the crew made temporary repairs to stop the leakage by using silicone sealant to repair the damaged gasket.

Subsequently, after the spares had been received, the second engineer assisted by the chief engineer proceeded to install the new gasket. The second engineer temporarily withdrew from the workplace to attend to another task, leaving the chief to open the cover plate without assistance. As he removed the holding nuts and pulled at the cover plate, after considerable resistance it suddenly came away and fell on his little finger, crushing it against casing of the FW generator.

The chief engineer immediately informed the master and first aid was given at the ship's hospital. After consulting with the company, the ship was diverted to the closest port for medical assistance, where the ship arrived after half a day. However, due to extensive crushing of the bone and tissues at the tip, the injured finger had to be amputated. The chief returned on board after two days in the hospital and resumed his full duties after 10 days of recovery.

Root cause/contributory factors

1. No risk assessment carried out prior to conducting the task;

2. Inadequate support/assistance: lack of assistance during handling the heavy steel plate cover;

3. Inappropriate maintenance: damaged gaskets repaired and sealed by silicone sealant. Had the appropriate gasket been used, the plates would have come apart easily.

4. Inadequate evaluation of changes to the steel plate under heat stress: due to build-up of heat stress in the plates, they sprang loose from their securing position when the stress was released suddenly;

5. Delay in receiving spares.

Corrective/preventative actions

Fleet instructions promulgated regarding:

1. Risk assessment to be carried out before undertaking tasks, and suitable control measures to be taken to minimise/reduce adverse consequences;

2. The importance of using only the correct replacement gaskets and seals. Temporary means of repair should be avoided.

3. The dangers of using inappropriate sealing material for equipment exposed to heat/pressure conditions.

▲ Figure 1: View of FW generator cover plate coming off the holding studs

MARS 201027
Fatal boiler explosion after chemical cleaning

Official report: edited from MAIB *Safety Digest* 2/2008, Case 7

An LNG tanker was berthed alongside a shipyard, undertaking repairs to her port and starboard main boilers. The work included extensive re-tubing and air casing repairs and it was carried out by a well established boiler repair contractor who was familiar with the vessel. The ship managers' technical superintendent and the repair contractor's technical superintendent were both on site.

As the repairs neared completion, the repairer sub-contracted a UK chemical cleaning expert, who was well known to him, to carry out the post-repair chemical clean of the internal surfaces of the boilers. Inhibited sulphamic acid was selected as the cleaning agent. The inhibitor component protected the boiler steel from acid attack, a by-product of which is hydrogen gas. The inhibited cleaner also contained a colouring agent to indicate the acid strength.

After completing shipyard-sponsored safety training, which included permit to work and entry into confined space routines, the cleaning expert set up his equipment. However, he did not have a method statement or any risk assessments to support his work, and neither the prime contractor nor the managers' technical superintendent asked for them. There was a blind acceptance that he was the expert, and those on site, including the ship's engineers, had virtually no interaction with him.

Following a successful pressure test, the starboard boiler was cleaned of oils and greases using a proprietary alkaline cleaner. This went without incident and was completed the following day. Meanwhile, the ship managers arranged for a Danish chemical cleaning expert to oversee the clean on their behalf. This was not unusual in the case of high-value contracts but neither the prime repair contractor nor the UK chemical cleaning expert was aware of his impending arrival.

At 08:00 on the day of the chemical clean, the water was heated up and circulated around the boiler. By 13:00 the water was at 57°C. The overseer, worried that the continued heating would be detrimental to the effectiveness of the inhibitor, recommended that the heating steam be turned off. By mid-afternoon, 800kg of sulphamic acid had been added to the water/acid mixing tank. At 17:00, tests were carried out which confirmed that the inhibitors were still active and the water/acid colour and pH readings confirmed that the acid strength was still satisfactory. Although checks were made to ensure there were no leaks, there was no indication that any checks had been made on the ventilation system, if indeed it had been fitted. By 21:00, things had changed rapidly. Tests indicated that the boiler steel was being attacked by the sulphamic acid.

The UK expert was rather sceptical about the interpretation of the test results because he had expected to circulate the water/acid mixture for a few more hours. However, he agreed to stop circulating it and reconfigured the system to pump the mixture into a shore-side bowser. In the meantime, he asked the repair contractor to arrange for the after door of the starboard boiler steam drum to be opened so that the internal surfaces of the boiler could be inspected.

At about 21:45 the steam drum door was opened, and as the contractors pushed the door into the drum there was a noticeable suction as the seal was broken. The workers also moved a non-intrinsically safe halogen lamp to a handrail near to the steam drum. At 22:00, both the cleaning experts approached the steam drum door. No tests were conducted to check the steam drum atmosphere for either toxic or flammable gases. The UK expert picked up the halogen lamp and placed it just inside the steam drum. The Danish expert saw a small flame or spark, and an explosion immediately followed.

The UK expert was thrown backwards about 4.5 metres; he was found to be unconscious and had suffered a number of fractures and severe burns. Sadly he failed to recover from his injuries and died nine days later. The Danish expert was also burned, but less severely. There was no fire or severe damage to either paintwork or structure.

Root cause/contributory factors

1. Accumulation of hydrogen gas in the steam drum, which evolved during the cleaning procedure. As the steam drum door was opened, the air combined with the hydrogen to create a mixture that was within the hydrogen's wide explosive limits;

2. Insufficient arrangements were made to ventilate the boiler and so release the evolved gases to atmosphere. Had the boiler been properly ventilated, the hydrogen build up would not have occurred;

3. The introduction of the hot halogen lamp into the untested, confined space of the steam drum, which was known to have possibly contained flammable gases, was a serious error of judgment.

Lessons learned

1. Every enclosed or confined space must be ventilated properly before entry or repair work commences, and the atmosphere must be correctly tested for both toxic and flammable gases before being certified as being safe.

2. All ISM documentation must be fully complied with, especially those detailing the crew's responsibilities relating to contractors.

3. Crew must actively be involved and interested in the contractors' activities and must communicate and clarify any doubts.

4. Product and material safety data sheets of materials must be carefully studied and dangers associated with its use must be understood and appropriate control measures must be in place to mitigate the risks.

5. Sulphamic acid will liberate hydrogen gas as it attacks scale and steel and the work site must be tested for the presence of hydrogen after the cleaning operation.

6. Only intrinsically safe lighting systems shall be used in confined spaces.

▲ Figure 2: remains of the non-intrinsically safe halogen lamp that caused the explosion

More information can be found on the link www.maib.gov.uk/cms_resources.cfm?file=/MerchantVessels.pdf

MARS 201028
Facial injury caused by gangway winch handle

A container feeder vessel had just berthed at a terminal for cargo operations and the seaman assigned to lower the gangway reported to the duty officer that the controls of the electrical winch motor were unreliable. Accordingly, the gangway was lowered manually by means of the winch handle and rigged for access.

With minimal manning, and the absence of a dedicated electrician, the chief engineer took it upon himself to attend to the problem, despite having been continuously engaged in manoeuvring and maintenance tasks over the previous 12 hours without rest.

At around the time he completed the electrical fault-tracing and was ready to test the winch motor, the stevedores changed shift and there was also a change of watch at the gangway with a new seaman taking over.

While the new seaman was adjusting the gangway using the handle to allow the new shift to come aboard, the chief engineer arrived at the winch motor control stand, situated within a few metres from the seaman, and without thinking of the consequences, energised the motor. The sudden activation of the motor caused the handle to snatch violently from the seaman's grip and strike his jaw from below with great force, throwing him on the deck. After administering first aid on board, the seaman was taken ashore to a hospital where multiple facial fractures were detected resulting in his repatriation home.

■ **Editor's note:** Overwork and fatigue may have contributed to this incident, causing a momentary lapse of concentration on the part of the chief engineer. There have been many similar accidents when the lifeboat winch motor has been inadvertently energised with the manual handle engaged. These incidents once again highlight the importance of conducting a careful risk assessment and a tool-box meeting, especially when working to rectify faults under pressing circumstances.

MARS 201029
Fatal electrocution

Official report: edited from US Coast Guard *Marine Investigation: Lessons Learned* 03/10

The US Coast Guard has issued a safety alert about the importance of properly maintaining and repairing vessel

▲ Figure 3: View of the damaged light fixture with exposed live components

electrical systems including those located in inaccessible or confined areas.

In a recent casualty, a young mariner employed on board a Great Lakes bulk carrier was electrocuted while working in a dark and confined cargo tunnel beneath the ship's cargo holds. Another crew member who went to his aid also received an electric shock from the same source and sustained a serious injury.

The investigation revealed that the heads of both crew members had contacted a deckhead lamp fixture that was damaged and improperly repaired. The fixture lacked a light bulb, a globe, and a guard. It appears that, at one time, the fixture was separated from its connection box and a repair was made using insulation tape to cover some open wires without properly replacing the connecting fitting between the fixture and the box. It also appears that the connection box was not earthed due to the use of plastic cable ties instead of solid metal fasteners.

It is vital that all crew members do their best to ensure their safety as well as that of their co-workers by reporting and acting to correct unsafe conditions. It is also critical that vessel and shoreside management personnel establish and maintain effective programmes where unsafe conditions like this one can be reported, acted upon and effectively managed. These principles have been widely adopted in on board safety management systems. In this incident, a hazardous condition was found but the repair was grossly inadequate and did not eliminate the unsafe condition.

As a result of this casualty, the Coast Guard strongly recommends to vessel owners/operators, port captains/engineers, crew members, and marine inspection personnel, especially those associated with older vessels, to be alert for such hazards and to take immediate action to report, properly document and correct any hazardous condition.

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MARS is strictly confidential and can help so many – please contribute.

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