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## MARS 201152

## Dangers of Aluminium Phosphide

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A container vessel loaded some containers of Aluminium Phosphide (IMDG Class 4.3, UN No. 1397) from an Asian port. The consignment used plastic bags as inner packaging and steel drums as outer packaging. The drums were then secured on wooden pallets and these were finally stacked inside a standard marine freight container.

During the voyage, the crew heard a number of small 'explosions' inside one of these containers, after which some smoke escaped past the rubber seals of the door. On seeing the smoke, the crew assumed that the cargo inside was burning and sprayed water on the outside of the container exterior in order to cool it.

Although the cargo had been correctly declared at the time of shipment, the relevant Material Safety Data Sheet (MSDS) was not provided to the carrier or to the vessel. The crew was unaware of the fact that contact between water and Aluminium Phosphide produces phosphine, an extremely flammable and toxic gas. (See Editor's note)

The vessel diverted to the nearest port down the coast, where the affected containers were discharged. During the discharge operation, further small explosions were heard coming from the within the other containers. The landed containers were then opened by fire-fighters and the palletised drums were removed. The 'explosions' were actually the sound given off by drum lids 'popping off' due to internal heat and gas generated by the chemical reaction.

When the remaining intact drum lids were removed to access the bagged contents, there was a mild 'pop' and white smoke emanated from the cargo. The plastic bags were melting due to the heat generated. The attending fire-fighters employed dry powder extinguishers to quench the 'fire' in each drum.

Meanwhile, the manufacturers were contacted and they sent a team of workers to the port of refuge to repackage the cargo for onward carriage to its final destination. It was evident that these workers were unaware of the hazards of the cargo and correct handling techniques, as they casually went about their task repacking the smouldering cargo.

The manufacturers argued that the port had handled the steel drums incorrectly when they were unloaded from the containers because they allowed the contents to be exposed to the atmosphere. This allegedly caused the cargo within the drums to react with the moisture in the air, initiating a phosphine-producing reaction. Even at the port of refuge, the shippers still had not provided the vessel or the stevedores with the correct MSDS, thus exposing the ship's crew and local workers to serious injury and health risks.

Clearly, the incident could have been very dangerous if the crew, in an attempt to extinguish the 'fire', had decided to pierce the containers and spray water inside, causing flammable and toxic gases to be produced in significant quantities.

It is essential that ship's crew insist that the shipper provides them with the relevant MSDS for all potentially dangerous cargoes that are to be shipped on board, so that they can safely and properly deal with any emergency involving the cargo.

■ **Editor's note:** Even without the correct MSDS, the ship's crew should not have been unaware of the cargo's properties and recommended emergency actions as it is mandatory for every dry cargo vessel to carry copies of the relevant IMO publications – the IMDG Code for packaged dangerous goods and the IMSBC Code for dry bulk cargoes. Both contain a brief description of a substance's physical and chemical properties, general stowage recommendations and emergency action to be taken in case of spillage and fire. Before shipping dangerous goods or bulk cargoes, such information must be understood by the ship's command and a training session must be conducted and documented where the crew is to be properly briefed on the dangers and trained in safe handling techniques and emergency procedures. If carriage of specialised safety equipment (eg gas masks, chemical suits etc.) and instruments (eg gas and temperature measuring/monitoring devices) is recommended, it is the vessel's responsibility to demand these and the shipper's duty to provide them.

For UN No. 1397, the EmS (Emergency Schedule) in the IMDG Code recommends:

Wear suitable protective clothing and self-contained breathing apparatus when dealing with spillage or fire. Avoid all sources of ignition.

**Spillage:** *On Deck* – If dry; contain and collect spillage, where practicable, for safe disposal overboard. Avoid contact with water except to wash residues overboard with copious quantities of water. *Under Deck* – provide adequate ventilation. Check atmosphere before entering space (toxicity and explosive hazards) and use self-contained breathing apparatus. Keep dry and collect spillage, where practicable, using soft brushes and plastic trays for safe disposal overboard. If wet, use inert (non-combustible) absorbent material and dispose of overboard.

**Fire:** *On Deck* – For packages, smother with dry inert powdered material or let fire burn. Remove receptacles likely to be involved but if not practicable, cool nearby cargo with copious amounts of water. For cargo transport units if the fire is not igniting nearby cargoes, let the fire burn, otherwise cool the unit with copious quantities of water. *Under Deck* – stop ventilation, batten down the hatches and use ship's fixed fire-fighting installation (not water). Otherwise adopt action as for *On Deck*.

▲ Exothermic reaction melting the inner packaging (plastic bag)

Workers without ▶ personal protective equipment (PPE) re-packing the consignment, risking exposure to toxic phosphine gas

## MARS 201153

## Human error causes oil spill

One of our tankers was discharging cargo alongside at an oil terminal in USA, when an overflow of Low Sulphur Marine Gas Oil (LSMGO) occurred from the vent pipe of the starboard Diesel Oil (DO) storage tank. The overflow was stopped immediately and spill control measures initiated, however some of the oil had flowed over the gutter plate and escaped overboard. Spill abatement and control measures were carried out by the Qualified Individual (QI) under the supervision of the USCG.

### Result of onboard investigation

In preparation for internal transfer of LSMGO, the junior engineer independently chose to prepare the receiving (DO storage) tank and line up the valves and the fuel oil (FO) transfer pump just before the end of the evening watch, which was about to be handed over from the third engineer to the fourth engineer. Observing that there was a small quantity of remnants in the receiving tank, the junior engineer decided on his own that it would be prudent to transfer this into a drain tank. As per established procedure, he inspected and confirmed that the line from the FO storage tank (which temporarily contained the LSMGO to be transferred the next day) was isolated, opened the suction to the receiving tank and inlet valve of the drain tank, and started the FO transfer pump (vertical shaft, centrifugal type) locally from the bottom platform. This transfer should have taken only a couple of minutes. Once the receiving tank was confirmed to be empty, he proceeded to stop the transfer pump locally and shut the inlet valve of the drain tank.

Unfortunately, on this occasion, the junior engineer did not press the stop button hard enough to deactivate the motor. The design and location (below the bottom plates) of the FO transfer pump was such that, apart from the indicator panel in the control room (ECR), the only reliable method to ascertain its status was to look at the exposed portion of the drive shaft from inside the bilge space, as its motor does not generate sufficient noise to be audible above the engine room noise. Believing that pump was now stopped, the junior engineer reopened the suction valve of the FO storage tank and the inlet valve of the DO receiving tank in preparation for the transfer the next day. Other stop valves along the line were normally kept open for convenience, and it had become the established practice to route and control transfers by operating valves at the pump.

The junior engineer then went to the ECR, where the watch was being handed over, but did not inform either of the watch engineers about the transfer preparations that he had executed. He also failed to check the ECR panel to confirm the status of the pump, which was now transferring LSMGO from the FO storage tank to the DO storage tank. At the same time, the fourth engineer, having taken over the watch, was concentrating on the inert gas plant and cargo pump turbines, and did not notice the status of the fuel oil transfer pump on the rear ECR panel. After about an hour, the DO storage tank began to overflow. The fact that the transfer pump was operational was only noticed when the fourth engineer was informed about the spill by the C/O from the deck.

### Lessons Learnt

**1.** Operation of valves and pumps associated with the fuel system are to be only carried out under the direct supervision of the watch keeping or senior engineer. This task is not to be entrusted to the junior engineers or ratings.

**2.** The Chief Engineer to include strict instructions in his standing orders that any internal transfer including those from/to drains tanks must be carried out with his permission and under direct supervision of the duty engineer.

**3.** The internal transfer checklist as part of the SMS must be properly used.

**4.** The duty engineer must exercise strict control over all activities undertaken by the personnel during his watch and must ensure that he is informed of all the activities being performed in the engine room.

**5.** Any pump must be reliably checked after stopping to confirm that it has actually stopped. Where pumps and system are started by local control buttons/ switches which do not have indicators, a positive means of identification of the state of the pump must be obtained from the ECR or by other physical means.

**6.** Senior engineers are to ensure that all personnel are sufficiently trained in the fuel pumping and piping system, especially where specific arrangements have been made for segregating LSMGO in emission control areas.

## MARS 201154

## Sea suctions choked with fish

Our oil tanker was discharging at an Asian oil terminal. Simultaneously, the vessel was being inspected by a vetting inspector and the owner's superintendent was also attending. The inert gas (IG) plant was in operation. About four hours into the discharge, the C/E was informed that the seawater low pressure alarm had been activated. He came to the engine room and observed that all the sea water pumps were showing inadequate discharge pressure. At the time, the high sea suction was in use, and even though it was well under water, the C/E instructed the duty engineer to change over to the low sea suction in order to improve the head. Immediately, the pump suction and discharge pressures became normal. After monitoring the system for some time, the C/E left for his cabin. After a few more hours, the problem recurred and the C/E again returned to find all seawater pumps had developed vacuum condition on the suction side and were showing very low discharge pressures. It was immediately suspected that the strainers inside the sea suction chests were clogged. However, with the cargo pumps and IG plant operating at full capacity, it was decided to use both the high and low sea suctions together to avoid stoppage of any of the seawater pumps. It was not possible to open up any of the sea chests to clean the strainer without halting the discharge, with attendant commercial implications. The Master and superintendent were informed of the serious situation, when, by chance, the terminal announced a temporary stop in cargo operation. Until this stoppage time, the engine room had spent a nervous few hours with the pumps struggling to develop adequate water flow.

In the middle of this crisis, a class surveyor was scheduled to attend for annual survey. On arrival, he declared his intention of testing the operation of the deck foam monitor with both fire and service pumps, which was quite a tough task under the circumstances. With great trepidation, the engineers were able to adjust the pump suction and discharge valves to satisfactorily demonstrate the operation of the deck foam monitor. Soon after the departure of the class surveyor, cargo operations were halted at the terminal's request and with the IG scrubber and condenser sea water pumps stopped, and auxiliaries under control, the low sea chest was opened up for inspection. A mass of tiny fish was found inside, and when the strainer was extracted, it was found to be completely choked from the suction side. After non-stop work by the crew, the suction was completely cleaned out, and the strainer replaced after the mesh was cleared. After the sea chest was boxed up, it was put in use and all seawater pumps were tested and found to be developing normal pressures. The high sea suction was also found to be choked with fish, and was similarly cleared and boxed up, by which time cargo discharge was resumed, with terminal instructions for continuous discharge until completion. Unfortunately, just four hours after resuming cargo discharge, seawater pressure again became low, forcing the simultaneous use of both sea suctions. The Master and superintendent were regularly updated of the situation, when, without prior intimation, port state inspectors boarded the ship. The mess near the sea suctions was quickly cleaned up, and the vessel passed the inspection creditably despite the accumulated stress of the past 24 hours. Just after the port state inspection, and towards the end of cargo discharge, abnormally high temperatures were observed in the steam condenser shell and condensate lines, calling for urgent corrective actions. Discharging was finally completed later that night. An exhausted engine room crew once again opened, cleaned and boxed up the sea suctions (again filled with tiny fish) and the ship sailed from the terminal without any delay, much to everyone's relief.

## Corrective / preventative actions

**1.** The fleet (especially a sister vessel) was advised to use high sea chest in ports as this is generally located close to several overboard discharges; e.g. ballast, condenser sea water, fire and general service (GS), and IG scrubber pumps. The turbulence created in the vicinity of these overboard discharges may help prevent fish being drawn towards the high sea suction.

**2.** It was also suggested that regular injection of steam into sea chests might assist in keeping the strainers clear of unwanted fishes and other organisms.

◀ View of clogged strainer of sea chest

Sea chest with ▶ strainer removed

# MARS 201155

## Gangway damaged during unberthing

One of our vessels was to move from her berth (port side alongside) and tie up at another berth (starboard side alongside) further up the dock. A pilot and two harbour tugs arrived at the designated time and Master - Pilot information was exchanged before commencing the movement. The pilot requested that the port accommodation ladder be hoisted by only a few metres and retained there, as he intended to use it for disembarking from the 'sea' side at the next berth. Due to the ship's draught, height of the pier and the state of tide, in this 'raised' position, the gangway was only about a metre clear of the jetty.

During the unmooring operation, there was a strong off-shore wind and moderate rain, and due to the latter, both the Master and the Pilot remained inside the wheelhouse throughout. On the pilot's advice, all headlines and sternline(s) were first let go, retaining only the backsprings fore and aft. After the sternline(s) had been retrieved on board, the deck officer in charge of the aft mooring station went over to the backspring winch, which was situated on starboard main deck, forward of the accommodation. He engaged the gear of the mooring winch and slackened the aft backspring. From his location across the full width of the ship, the deck officer had no view of the quayside, and was relying on and responding to hand signals from an A/B stationed at the ship's port side. Due to the low clearance between the gangway and the jetty, the length and lead angle of the mooring line and the widening gap between the ship and the berth, the slack backsprings became fouled with the accommodation ladder and could not be cleared despite efforts by the shore mooring gang.

The A/B indicated the dangerous situation by hand signals to the deck officer, creating some critical seconds' delay in responses and in communicating the information to the bridge. Once aware of the situation, the Master requested the Pilot to instruct the tugs to push the vessel back towards the jetty , but by the time this was done, the entangled gangway had been subject to severe axial, twisting and crushing forces and was severely damaged.

## Root cause/contributory factors

**1.** The Master failed to effectively use the Pilot and tugs to retain the vessel alongside until all lines were retrieved, especially since there was a strong offshore wind;

**2.** The Master failed to exercise basic seamanship and wear rain protective clothing and station himself on the bridge wing during the unmooring operations;

**3.** The unusual layout of the backsprings, gangway and low clearance over the berth should have precluded leaving the gangway suspended overside;

**4.** The deck officer at the aft mooring station wrongly assumed the role of winch operator, instead of directly supervising the operation and delegating tasks to his crew.

## Corrective/preventative actions

Instructions issued to all vessels in the company requiring:

**1.** Masters to always position themselves on the bridge wings during mooring and unmooring and closely oversee and control operations;

**2.** Members of the bridge team to always be suitably prepared for exposure to varied weather conditions;

**3.** Adequate weather-protective gear to be always be available in the wheelhouse;

**4.** Officer in charge of the mooring station to supervise the operation and effectively communicate with the shore and ship's staff and delegate tasks to his team.

◀ View of damaged accommodation ladder

Another view ▶ of damaged accommodation ladder

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Reports will be carefully edited to preserve confidentiality or will remain unpublished if this is not possible.

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