THE SWEDISH CLUB CASEBOOK

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Cargo - bulk

1.1 Charcoal: Incorrect declaration caused charcoal fire

The container vessel was sailing in open sea when smoke was seen coming from the vent of one of the cargo holds. The Master sounded the general alarm and all crew were mustered and accounted for.

A fire team was assembled and proceeded to shut off the ventilation and close the fire dampers for the cargo hold. An access hatch cover was opened for the fire team to enter the cargo hold, but it was full of smoke and there was no visibility, so the team turned back and closed the hatch.

CO_2 release

The Master decided to release CO_2 into the cargo hold and the vessel turned back to its last port of call. After the CO_2 had been released some smoke could still be seen coming from the cargo hold, but it was less than before. The crew could not find any hotspots on deck.

The crew inspected the adjacent cargo hold to see if there were any hotspots or discolouration. They could not find any.

After the vessel berthed the local fire brigade embarked and confirmed that the fire was extinguished.

Misdeclared cargo

The cargo manifest did not show any dangerous cargo loaded in the affected cargo hold. However, it was found that the container that caught fire was loaded with charcoal, and that the shipper had declared that charcoal was not classed as IMDG dangerous cargo.

It was later confirmed in laboratory tests that the cargo should have been classed as dangerous cargo as per IMDG code class 4.2.

What can we learn?

- The IMDG Code for charcoal, if it applies, requires adequate heat treatment and then cooling of the charcoal before packing. This is to reduce the charcoal's reactivity by allowing it to oxidise under controlled conditions.

- Charcoal may not be subject to the IMDG Code, if it passes a UN test for self-heating, thus indicating that it is not too reactive. This exemption requires correct sampling, testing and certification and it may assist to check the relevant documentation. This had unfortunately not been done correctly in this case.

1.2 Coal: Severely burned in an onboard explosion

The capesize bulk carrier had loaded steam coal in all seven of its cargo holds. The Master had received the cargo declaration from the shipper where it mentioned that there was a risk of methane release, which is common for coal cargo.

During the voyage the vessel had sailed through heavy weather conditions which reached Beaufort scale 8, but at the time of the incident it was a clear winter evening.

The vessel was approaching port to anchor while waiting for a berth to be ready for discharging, and the bosun and an AB went to the forecastle to prepare the anchor.

Access to windlass control room

To start the anchor windlass, they had to enter the windlass control room on the forecastle. The forecastle was slightly elevated from the main deck and a ladder had to be used to reach it. The door to the windlass control room was below the forecastle, facing the stern towards the cargo hatch coamings of cargo hold 1. The hydraulic panel for the anchor windlass was inside the control room as were other equipment panels. The access hatch to cargo hold 1 was also in the room.

Explosion

The two crew members entered the room and approached the windlass panel. The bosun pushed the start button. At that moment there was a major explosion in the room.

On the bridge they heard a large bang from the bow but could not really see what had happened because it was dark outside.

The Chief Officer and another AB rushed to the bow to see what had happened. The Chief Officer approached the forecastle and touched the bulkhead to the windlass room. He could not feel any heat. He then shouted for the bosun but got no answer. He decided to open the door. He looked inside and there was almost no smoke in the room, but there were two bodies lying on deck, not moving. He could see that it was the bosun and the AB and he called on the radio for medical assistance and asked that two stretchers should be prepared.

Medical assistance

The Master called the VTS and asked for medical assistance. It took 10 minutes for the Second Officer to arrive at the scene with first aid equipment, and soon afterwards crew members came with two stretchers. The bosun and the AB had severe burn injuries, and there was not much the Second Officer could do but to give first aid and ensure that both men were breathing.

An hour later a coast guard cutter with paramedics arrived and the injured crew members were taken ashore. They were flown to a specialist hospital where they received help.

Both survived but had to undergo painful surgery and it is unknown if they will ever be able to work at sea again.

What can we learn?

- It is probable that an accumulation of methane gas occurred within the windlass control room. The gas mixed with the air allowed the right concentration of gas to be ignited inside the hydraulic control panel by a switch or relay. The resulting ignition within the panel created an explosive flame and pressure wave that rapidly expanded into the control room. It seems likely that the methane gas entered the control room through the cargo hold access hatch.

- After the incident the windlass control room was classified as an enclosed space, which means that the crew must test the atmosphere before entry to ensure it is gas free and has enough oxygen.

- The crew had planned to carry out gas testing of the cargo during the voyage. However, because of the heavy weather no testing was done the first week. Tests were carried out during the last five days before arrival; no excessive amounts of methane gas were detected. An attending surveyor stated that the onboard gas testing equipment was not suitable for cargo testing but was designed for personal use when entering a cargo hold.

- There should be testing equipment on board that meets the requirements of the IMSBC Code. It is also critical that the crew is properly trained on how to use the equipment. The vessel should have at least two gas meters on board (in case one should fail) with certificates of calibration that will cover the period of the voyage. At a minimum the meters should measure methane (usually in % of Lower Explosive Limit or LEL), carbon monoxide and oxygen. The LEL is the lower limit, below which a mixture of methane and air will not explode. For normal air (21% oxygen) the LEL is 5% methane. Gas meters usually measure the percentage of LEL with 100% representing 5% methane in air. Coal emits methane to varying degrees.

1.3 Coal: Indonesian coal self-ignited during discharge

The bulk carrier had loaded Indonesian coal to be discharged at another Asian port. After loading, all the hatch covers and openings were closed and sealed. During the voyage, the cargo holds were monitored by taking gas readings and temperatures. All values were within the parameters stated in the IMSBC Code.

Discharging the coal

The vessel arrived at the anchorage for the discharge port. After a short wait, discharging began (by the vessel's grab into barges). Initially, all went smoothly. However, after a few days of discharging, smoke started coming out of cargo hold 3. The coal that remained in this cargo hold had been left heaped in 6 metre piles by the bulkheads. A fire team was assembled and when they reached the cargo hold they could feel heat on the deck. Thick, dense black smoke then began coming out of the hold, although no flames were visible. The atmosphere in the hold was tested by the fire team and it was 66° C, methane gas levels were at 120% LEL, and the CO level was above 3,680 ppm.

At this point smoke then started coming out of hold 4 which was almost empty. Again the cargo in this hold was in large piles by the bulkhead. The temperature was 69° C, methane levels were at 144% LEL, and CO levels were in excess of 10,000 ppm.

Expert guidance sought

The Master informed the DPA and charterer that the coal had self-ignited. Expert guidance was sought. There was now a risk of an explosion in holds 3 and 4. Flames could be seen on the surface of the coal. Two fire teams were assembled in full firefighting gear. They rigged the fire hoses and sprayed the coal with seawater.

The Master wanted the remaining coal from holds 3 and 4 to be discharged and the following night the discharge from holds 3 and 4 continued to different barges. The next day, and in conjunction with the expert's advice, the Master ordered holds 3 and 4 to be flooded. This action extinguished the fire.

What can we learn?

- There is nothing to indicate that the self-heating/combustion was in any way related to the actions of the Master and/or crew.

- Indonesian coal is prone to self-heating/spontaneous combustion. This is related to oxygen combining with carbon in the coal (oxidation) and this reaction produces heat. When the heat produced cannot dissipate - in this case due to the insulating effect of the surrounding coal - the temperature of the coal increases. Carbon monoxide (CO) is produced as a result of the self-heating/combustion reaction. As the temperature of the coal increases, so does the rate of the oxidation reaction. This is why guidance is given in the IMSBC Code to close the ventilation after loading as soon as it is apparent that flammable gas is not accumulating.

- When self-heating of coal has been restricted by reduced oxygen levels, such as during the voyage, self-heating will not become immediately apparent on exposure to higher levels of oxygen. Self-heating is a function of temperature, so the self-heating needs to occur for a sufficient time to raise the temperature of the coal before a runaway reaction will occur. This time period depends on the amount of oxygen that can permeate into the stow and support self-heating.

- The holds were not ventilated prior to the vessel's arrival at the discharge port. The holds were only opened when discharging operations began. During discharge, oxygen will inevitably have entered the holds.

- The period between the start of discharging and the noticeable increase in carbon monoxide is consistent with exposure of the coal to atmospheric oxygen levels during discharging operations.

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1.4 Grains: Wet damage caused cargo loss

The handysize bulk carrier docked in a European port and loaded wheat into all its four cargo holds for discharge at an East African port. Prior to loading, the crew cleaned the cargo holds by washing them with seawater and rinsing them out with fresh water. A pre-load inspection took place at the port, during which the shipper's surveyor found the bilges dry and the cargo holds suitable for receiving the cargo.

Before departure from the loading port the water ingress alarm was tested by the Chief Officer and found to be in good order.

During transit through the Bay of Biscay the vessel encountered rough weather. The vessel's logbook recorded winds of Beaufort Scale 7-8, with high waves washing over the cargo hatch covers. Although daily sounding sheets showed no water in the bilges and no water ingress alarms sounded, the Master nevertheless prepared a note of sea protest in connection with the heavy weather.

Discharge

Upon arriving at the discharge port the holds were opened and the cargo was visually inspected by the cargo receiver. No issues were noted during this inspection and there was no sign of water ingress.

Discharge operations began via grabs into trucks, with all the cargo holds being discharged simultaneously. The trucks transported the cargo to the receiver's facility. Upon arrival at the receiver's facility the trucks unloaded their cargo in a single grain intake pit from where it was transferred into silos.

Damaged cargo

As discharge progressed and after most of the cargo had been discharged, a surveyor acting for the cargo receiver noticed some damaged cargo towards the bottom of cargo hold 1. This was described by the crew as a thin layer of wet cargo near the tank top. Efforts were made by the crew to segregate the relatively small amount of wet cargo from the sound by placing it in plastic drums, but the stevedores insisted that discharge operations were suspended. After some consideration and several days delay, it was agreed that the damaged cargo could in fact be properly segregated, and discharge operations resumed.

However, after only some three or four truckloads of dry cargo had been discharged, the separation process became confused, resulting in wet and dry cargo being discharged together. This initial failure of segregation was exacerbated when the cargo was subsequently dumped into the single grain intake pit and from there was transferred into the receiver's silos.

Analysis

The discoloured/wet cargo was analysed by a local laboratory, and the results showed the cargo had been contaminated with seawater. No actual laboratory analysis for food safety parameters was carried out. However, based on the test results the laboratory stated that the cargo was unfit for human consumption. The laboratory did not suggest applying these results to the entire cargo from hold 1, only to the samples that were analysed.

Nevertheless, the cargo receiver applied this ruling to a substantial amount of the cargo from hold 1 - far greater than the amount of cargo that had been segregated by the crew.

Vessel arrest

The cargo receiver subsequently arrested the vessel and requested security of EUR 2,000,000 to cover their losses.

Subsequent investigation

The receiver sought to rely on the clean bill of lading and the fact that cargo was discharged in damaged (wet) condition. While there was undoubtedly an issue of wetting while the cargo was on board the vessel, subsequent investigation showed that the real issue was the way in which the cargo had been handled during and following discharge from the vessel, as the stevedores failed to take proper care to effectively segregate sound from damaged cargo, but in fact mixed the few tons of wet cargo with a much larger quantity of sound cargo that had been discharged from other cargo holds. This led to a far larger claim than ought ever to have arisen.

A full investigation into the source of the water ingress could only take place at the next port, when the vessel was cargo-free. That inquiry revealed the source to have been a partially corroded pipe, which had not been picked up during an inspection of the cargo holds at the loading port.

Settlement

The cargo receiver subsequently sold some 7,000 million tonnes of the cargo as animal feed, although they were unable to provide adequate documentary evidence to demonstrate the reasonableness of that decision. The receiver's overall claims were subjected to London arbitration. Those claims were eventually settled amicably for around 15% of the total initially sought.

What can we learn?

- In general terms, when wet cargo is discovered on board the prudent action for a cargo receiver seeking to mitigate any loss is to segregate visually affected cargo from visually sound cargo during discharging. Sound cargo should then be stored separately from affected cargo and any alleged damage, or reduction in quality, should be proved by representatively sampling the suspect cargo followed by appropriate testing of the samples.

- In this case, efforts by the Club and the appointed P&I surveyor to properly investigate the extent of the wet cargo were hindered by the fact that attendance was not requested by the member until after the allegations of wet cargo were initially brought by the receiver (by which point the crew had already finished their initial segregation of the wet cargo). As a matter of good practice, it is extremely important that prompt notification is made to the Club whenever there is any allegation or suggestion of cargo damage. This is essential in order that the Club and their local representatives can properly investigate the facts and take all steps necessary to gather evidence and protect the member's position.

- Here, neither the cargo receiver nor the stevedores took appropriate steps to segregate this allegedly damaged cargo during discharge. On the contrary, their actions during discharge from the vessel and subsequently while transferring the cargo from the trucks to the grain intake pit and thereafter the silos were the cause of the largest part of the damage. These actions turned what should have been a nominal cargo damage claim into something far more serious.

- A foodstuffs expert hired by the owner was of the opinion that based on the test results the wheat would still have been suitable for milling and that it was uncommercial and unreasonable to have taken a decision to downgrade and sell so much of the cargo for animal feed production without making any proper attempt to establish the overall quality. Further, there was no evidence concerning the fate of the 7,000 million tonnes allegedly sold as animal feed.

- The best preventive action the crew can take in a situation like this is to take pictures and make detailed reports about any damaged cargo that is found. Clear photographs of the cargo and the loading operations are also invaluable. These should include an overview of how the cargo was loaded, the general view of the cargo in the holds during loading and, where possible, close-up photographs of the cargo itself.

- Before leaving port, the crew should inspect the hatch covers to ensure they are in weathertight condition. There should be no cargo in the drain channels, each hatch cover should be secured properly, paint should be intact and the gaskets and coamings should be in good condition. Cargo holds should be inspected not only in terms of cleanliness, but also for any signs of leaks or possible sources of water ingress that risks causing damage to the cargo.

1.5 Grains: Incorrectly applied fumigation pellets caused explosion

A bulk carrier loaded bulk grain in the US Gulf. The cargo was fumigated on completion of loading with the fumigator applying aluminium phosphide pellets to the surface of the cargo. The fumigation documents stated that the fumigation was a subsurface application with the aluminium phosphide applied evenly across the hold.

Explosion

Shortly after departure there was an explosion in one of the holds and the hatch cover was partially displaced. The crew then ventilated the other holds as a precaution.

Incorrect application

After the explosion, it was determined that the fumigant was only applied to the cargo surface from the hatch covers in two distinct longitudinal lines. This was evident from the fumigant residue in the other holds. The fumigant pellets were poured from buckets and there were piles of pellets visible on the cargo surface in direct contradiction to the fumigation manual application methods which advises that piles of fumigant should be avoided.

In addition to the structural damage to the vessel, the damage to the hatch cover meant that poor weather conditions caused cargo damage, despite the crew's attempts to cover the displacement caused by the explosion.

What can we learn?

- It is important to ascertain:
  - The fumigation application method and check that it corresponds to the information provided in the fumigation documents or certificate.
  - The type of fumigant, the formulation (pellets, tablets …) and brand of the fumigant.
  - The type of recirculation fan (if used).
  - The quantity of fumigant being used in each hold.
  - The distribution of the fumigant on the cargo.
  - The type of gas filter provided with any gas masks or PPE.
- In this case the fumigation pellets were applied incorrectly. A diligent Master needs to ensure that the fumigator's instructions are carefully followed to ensure that in transit fumigations are performed without undue risk.
- The Master and the crew should familiarise themselves with proper fumigation practice and maintain a detailed record of how the fumigation is carried out.

1.6 Grains: Ship's sweat caused cargo damage

A vessel loaded a cargo of white maize in Topolobampo, Mexico for discharging at several ports in Southern Africa. The temperatures experienced during loading were in the 30°Cs. The cargo was fumigated on the completion of loading. The vessel sailed around South America via the Magellan Straits and experienced ambient temperatures close to 0°C. The fumigation instructions required that the holds remained closed, and they were not opened until 12 hours prior to arrival at the discharge port.

Damaged cargo

On arrival at the first discharge port, the surface of the stow in all holds was found to be mouldy, condensation stains could be seen on the hatches and hatch coaming, and maize had germinated in areas of heavy wetting. This was a clear example of ship's sweat where moisture inside the hold space condenses on the interior steelwork due to the difference in temperature and then drips or runs into the cargo.

The surface layers of damaged cargo were manually segregated by stevedores and by grab. Once the surface layer of mould damage was removed the remaining cargo was discharged in sound condition.

What can we learn?

- The mould damage to the surface due to condensation wetting could have been prevented or minimised if the holds were ventilated after a more typical fumigation exposure period (often 10 days).
- It is important to clarify the ventilation instructions with the fumigators and charterers, as the fumigation instructions are focused on achieving an effective fumigation and do not account for the changes in environmental conditions the vessel may experience during a voyage.

1.7 Grains: Infested cargo

The supramax bulk carrier had loaded wheat for human consumption in a European port for discharge at a Middle Eastern port.

Cargo transfer

The cargo was loaded on board the vessel from a barge alongside and also directly from the quay, transported there by lorries which dumped the wheat in a pile on a large steel plate positioned on the quay. From this open pile the cargo was picked up by a ship crane and loaded into the holds. The vessel had five cargo holds.

Weather interruptions

The loading took about two weeks and during this time there were 12 breaks because of rain. At each rain break, the cargo remaining on the steel plate was picked up by the crane, loaded back on the lorries and removed from the quay. The steel plate was then supposed to be dried prior to loading resuming.

The Master was concerned at the frequent rain interruptions and the way the cargo was loaded from the quay. He stated that he had seen cargo being dumped on the wet steel plate, but he did not issue a letter of protest and nor did he clause the mate's receipts or bills of lading.

The cargo log showed that loading into the lower part of hold 3 took place across two hours in the evening and two hours in the early morning of the following day. This stoppage was due to rain.

Poor visibility

Due to the time of year, it became dark at 1600 and so it was difficult for the crew to observe the condition of the cargo properly during loading, or to see if the cargo in the hold was wet or not. There were no extra lights rigged for the cargo holds.

Fumigation

Before departure the cargo was fumigated professionally with aluminium phosphide tablets and seals were applied to all cargo holds. The crew also applied tape and foam on the cargo hatch covers to prevent any fumigant gas from leaking out.

Inspection

The vessel arrived at the discharge port and anchored. Officials boarded the vessel and unsealed the holds so they could inspect the cargo. The vessel then remained at anchor for another three weeks.

Issues at discharge

The vessel finally came alongside, and discharge commenced. Almost all the cargo in hold 3 had been unloaded when infested cargo was found at the bottom. In addition some of the cargo was lumpy indicating wet damage. The cargo that had already been unloaded was found to be sound and in good condition.

A salinity test was carried out on the damaged cargo and the result was negative. No saltwater damage was found.
The cargo receiver rejected the remaining cargo in the hold because of the insects and lumpy cargo.

After the damaged cargo was found, no more cargo was allowed to be discharged and the vessel had to depart.

What can we learn?

- It is likely that the cargo damage was caused by wet cargo being loaded on board in addition to inefficient fumigation in cargo hold 3 - there were no insects found in the other holds.
- It took 14 days for the vessel to be loaded and there were 12 rain stops during this time. Cargo was dumped on wet steel plates on the quay. It is unknown how the barge alongside protected its cargo from rain. All these circumstances are likely to have resulted in wet damage.
- Fumigation was carried out during the voyage and was undertaken with a gas recirculation system.
- If the fumigation failed for cargo hold 3, what was specific to this hold? It is probable that this hold, unlike the others, was not sufficiently tight. Before departure it is imperative that the Master checks that the cargo holds are weather-proof. It should be noted that hatch covers cannot be expected in practice to be 'gas-tight'. What is required for effective fumigation is that enough of the gas is retained in the hold for long enough to ensure the death of all insect life.
- Gas leakage from the hold may occur due to movement of the hatch covers during the sea voyage.
- It is important to ensure that all rubber packing on the cargo hatch covers is in good condition. The best way to do this is by an ultrasonic test.
- Make sure there is sufficient lighting at night to enable visual inspection of the cargo during loading. It is also essential that the crew monitors the weather reports and radar so that the cargo hatch covers can be closed before any rain starts. There was no note in the deck logbook as to whether the cargo hatch covers were closed or not during loading.
- If any wet-damaged cargo is observed during loading the Master should issue a letter of protest, make appropriate remarks in the mate's receipts and clause the bills of lading.

1.8 Soya beans: Discolouration

The ship loaded soya beans in South America. During the loading it was found that a very high percentage of the cargo had purple spots on the beans. After a joint survey, it was determined that 7%-8% of the cargo had purple spots on its surface.

Letters of Indemnity

Accordingly, the Master claused the mate's receipt, which the shipper protested about. The charterers and sub-charterers were also called upon to resolve the matter. Eventually, the mate's receipts were issued clean in exchange of Letters of Indemnity issued by the charterers and sub-charterers.

No claim made

At the discharge port, no claims were made in relation to the purple-spotted cargo. This was due to the receiver having been informed of the discolouration prior to loading. This demonstrates the importance of engaging in a dialogue with all relevant parties when discolouration is first discovered at the loading port rather than the discharging port.

What can we learn?

- Discolouration of beans can occur due to self-heating, or due to the growth of a fungus, or by dirt. If the soya beans are not damaged or discoloured internally, they are considered sound.
- The Club strongly recommends that members pay close attention to the apparent condition of the cargo prior to loading.
- The owner/manager should always consider obtaining assistance from an experienced surveyor, or cargo expert, or more conveniently call their Club for assistance whenever there are doubts about the condition of the cargo that is being loaded.

1.9 Soya beans: Poor condition when loading

The vessel loaded soya beans in a South American port, to be discharged in China. At the discharge port, the vessel was arrested for a claim for USD 3.8 million as it was found that 7%-8% of the soya beans were black.

Issues on loading

Investigation revealed that the black-coloured beans were already in this discoloured state prior to loading. It was further determined that there was no further discolouration generated on board during the voyage. It transpired that the discoloured cargo had been mixed with sound cargo during loading.

Problems observed

When loading, the Master had observed the extraordinary amount of black-coloured beans and informed the shipowner. However, no report was made to the Club and no surveyors were dispatched. The Club reserved cover relying on Rule 4 Section 3 of the Club Rules because the bill of lading was not issued properly, but was issued clean without any comments on the condition of the cargo. Eventually, the receivers waived a majority of their claim by settling for less than 10% (i.e. USD 300,000) of the initially claimed amount.

What can we learn?

- Carriage during hot seasons, prolonged storage at pre-shipment, and carriage of soya bean cargo with a high moisture content should all be avoided to reduce the risk of self-heating. It is nearly impossible to prevent self-heating damage when a cargo has a high moisture content, and this cannot easily be detected by the vessel's crew during loading. Therefore, members should always be aware of the factors that can contribute to a high moisture content in soya bean cargoes, which are as follows:

  • Ingress of rain and/or seawater
  • Broken pipes or overflowing bilges
  • Condensation due to lack of ventilation

- To avoid the risk of cargo damage, a vessel's crew should be warned of the potential risks beforehand.

- Discolouration of beans can occur due to self-heating or due to the growth of a fungus or by dirt. If the soya beans are not damaged or discoloured internally, they are considered sound.

- The Club strongly recommends that members pay close attention to the apparent condition of the cargo prior to loading.

- Cargo experts should be called upon immediately to observe the pattern of damage in the cargo hold(s) and to take samples for analysis for evidential purposes (i.e. for potential defence against a claim by cargo receivers).

- The owner/manager should always be ready to provide the Master with any assistance necessary in recording appropriate remarks on the bills of lading. When in doubt, the Club's assistance should be sought immediately. Such proactive response by members could significantly change the outcome of a soya bean cargo damage claim.

- The owner/manager should always consider obtaining assistance from an experienced surveyor, or cargo expert, or more conveniently call their Club for assistance whenever there are doubts about the condition of the cargo that is being loaded.

1.10 Soya beans: Ship's sweat caused cargo damage

A vessel loaded a cargo of soya beans in bulk at Santarem, Brazil in January due for discharge in Qingdao, China. The vessel sailed around the Cape of Good Hope and bunkered in Singapore, before continuing to Qingdao, China. During the first 15 days of the voyage, fumigation prohibited ventilation of the holds.

Delay at anchorage

The vessel arrived at Qingdao anchorage in March. The vessel was delayed at anchorage for over one month. No ventilation had been carried out during the voyage to China, but ventilation started in late March according to the Three Degree Rule. During the delay at anchorage, the surface of the cargo in all five holds started to deteriorate and mould growth became visible. As the vessel was only equipped with natural ventilation the effectiveness of this ventilation whilst the vessel was stationary at anchor was therefore extremely limited.

The voyage and delay totalled 105 days. According to the Three Degree Rule, there were between nine and 11 days (depending on the hold) when ventilation was required but not carried out. This means that for most of the voyage the correct ventilation decision was made.

Mould damaged cargo

The vessel eventually berthed and began discharging in late April. The first stages of discharge segregated the surface layers of mould-damaged cargo from each of the five holds and this was stored in a separate warehouse facility.

What can we learn?

- Inspections and cargo temperatures revealed heat damage throughout the stow, not only at the surface although the cargo condition gradually improved with depth.
- Representative sampling and analysis of the 'sound' cargo revealed heat damage throughout the whole cargo, which was worse in the quantity initially segregated from the surface.
- It was concluded that most of the cargo damage was caused by the condition of the cargo at loading and the subsequent delay at anchorage in Qingdao.
- The mould damage on the surface was exacerbated by the self-heating within the cargo which led to condensation in the headspace and occurred despite the crew's ventilation efforts.
- It is unlikely that the crew could have taken any further action that would have had a significant impact on the condition of the cargo at discharge.

1.11 Soya beans: Self-ignited after several months at anchor

A bulk carrier had loaded soya beans by conveyor belt in a South American port bound for a port in the Gulf of Arabia. The vessel arrived at the discharge port, but berthing was significantly delayed. The vessel had to remain at anchor for four months as the charterers had not been paid for the cargo. One day the crew discovered smoke and heat coming from inside the holds. Two days later the vessel berthed.

Total loss

Eventually, it was ascertained that a considerable amount of the cargo was damaged. The invoiced value was over EUR 4 million. However, due to the damaged cargo, the local authorities declared the entire cargo to be a total loss and ordered the cargo to be destroyed. The cargo receiver arrested the vessel and demanded over EUR 5 million in compensation.

Inherent vice

It appears that self-heating damage occurred solely due the inherent nature of the cargo. It was established that there was no water ingress of any kind. It was also established that the damage was not caused by heat from any fuel oil tanks adjacent to the cargo holds. All possible causes involving the negligence or unseaworthiness of the vessel were excluded in the investigation of a fire expert.

However, the Club received legal advice from local lawyers that it was highly unlikely that the owners could successfully rely on the 'inherent vice' defence before the local courts. The main reasons given were that: 1) local court action could drag on for years and 2) the local courts tended to protect local companies when they were in dispute with foreign companies.

Recovery

Based on the local lawyers' legal advice, the Club had to settle the case amicably with the cargo owners. However, the Club in turn made a full recovery by bringing a claim against the charterers under the charterparty between the owners and the charterers (more specifically, by relying on the Interclub Agreement).

The recovery action turned on the interpretation of clause 8(d) of the Interclub Agreement.

Clause 8(d) provides that:

"(8) Cargo claims shall be apportioned as follows:

...(d) All other cargo claims whatsoever (including claims for delay to cargo):

50% Charterers

50% Owners

unless there is clear and irrefutable evidence that the claim arose out of the act or neglect of the one or the other (including their servants and sub-contractors) in which case that party shall then bear 100% of the claims."

The arbitration tribunal agreed with the owners' argument. The English Court upheld the decision holding that the owners did not need to prove fault or negligence in connection with the charterers act. The charterers' appeal was dismissed.

The charterer ended up having to pay the owners the unpaid hire and 100% of the cargo claim the owners had paid, together with legal costs and expenses.

What can we learn?

- South American ports commonly use conveyor belts to load soya bean cargoes, which create airborne dust and particles around the holds. Under such conditions, the on-site crew may be unable to distinguish between dry cargo and cargo with a considerably high moisture content by visual and smell inspections. Nonetheless, the crew is advised to take photographs to demonstrate the poor visibility during loading operations.

- The Chief Engineer should ensure that all engineers and engine ratings are aware of the procedures for heating fuel oil to prevent any cargo damage.

- The crew should check the temperature of the cargo at regular intervals, preferably at least 50cm below the exposed surface of the cargo.

- The owner/manager should always consider obtaining assistance from an experienced surveyor, or cargo expert, or more conveniently call their club for assistance whenever there are doubts as to the condition of the cargo that is being loaded.

- During the voyage, the cargo should only be ventilated according to the Three-Degree Rule, which recommends that ventilation should only be carried out when the outside temperature is 3°C lower than the cargo temperature at loading.

- The ventilation logbook should be completed properly.

- At the discharge port, owners/managers are reminded to contact the Club immediately if there is any indication by the crew, the receivers, or the local authorities that cargo has suffered damage by self-heating.

- Cargo experts should be called upon immediately to observe the pattern of damage in the cargo hold(s) and to take samples for analysis for evidential purposes (i.e. potential defence against a claim by the cargo receivers).

- The carrier should not be held liable where the owner provides the same management and standard of care for the cargo holds containing the same type of cargo (i.e. soya beans), which was loaded in sound condition, but results in different outcomes in terms of damage.

- One of the most effective defences against cargo claims is the maintenance of clear and accurate records and documentation of each stage of the voyage, from loading through to discharge. The crew can assist by maintaining detailed and accurate logs and taking photographs throughout the voyage.

- The charterers alleged that the cause of the damage was the owners' failure to properly monitor the cargo temperatures. The Tribunal however found that the monitoring was not at fault and that the cause of the damage was a combination of the inherent nature of the cargo (and its oil and moisture content) together with the prolonged period at anchor at the discharge port.

1.12 Steel: Cargo damaged by rain during loading

The vessel was loading a cargo of steel. During loading intermittent rain occurred, at which point loading stopped, and the cargo hatch covers were closed. However, this was a time-consuming process as the cargo hatches could only be closed one-by-one which meant the top cargo became wet. The stevedores covered the cargo with tarpaulins to protect it from the rain.

A couple of hours later heavy weather hit the port and damaged the tarpaulin, which caused more water to enter the cargo hold. The crew covered the cargo with some plastic; however, 150 steel bundles were water damaged.

Interrupted loading

After the heavy weather had passed loading resumed, however more rain showers occurred, and the cargo hatch covers had to be closed three more times before loading was complete.

During the voyage the crew ventilated the cargo holds as per their procedures. In the discharge port the consignee claimed for rust damage to the cargo.

What can we learn?

- If any wet damaged cargo can be observed during loading, the Master should write a letter of protest and clause the bills of lading and cargo manifest.
- It is essential that the crew monitor the weather via weather reports and radar, so that the cargo hatch covers can be closed before the rain starts.
- Before loading commences, the Chief Officer should discuss the vessel's cargo securing manual with the stevedores and identify what is required for the specific cargo being loaded.
- A good preventive measure is to have a pre-loading meeting with the crew and stevedores before loading starts.
- If the temperature in the loading port is colder than the climate through which the vessel will sail, then no ventilation should be carried out. Cargo sweat will occur if the temperature of the steel is lower than the dewpoint of the atmosphere in the hold.
- If the steel is loaded in a warm climate, the holds should be ventilated to avoid the internal hold structures cooling to below the dewpoint of the atmosphere within the hold. This would cause ship's sweat to develop and drip on to the steel.
- When cargo is already present at the wharf key, observation must include all evidence of rusted steel with silver nitrate tests to verify any exposure to sea water/spray, any damage to products stacked at the wharf including bent bars, loss of strapping/unwinding of steel coils, extent of telescoping in the coil centre, loose outer laps on the coils, damage to coil edges and comments on the effectiveness of any covering for protecting the cargo at the wharf.
- The dunnage utilised must be suitably dried to avoid transfer of moisture to the product and to the hold's atmosphere. The dunnage must also be phytosanitary-certified and approved to ensure the wood is pest-free. Without this certification, the vessel may be banned from offloading cargo in some territories. Hardwood dunnage is preferred to avoid crushing during the voyage and consequential cargo damage.
- Ensure bills of lading are claused, relating to defects/abnormalities observed during the pre-loading and loading operations e.g. evidence of damaged straps, unwinding or telescoping, damage to packaging.

1.13 Steel: Cargo rejected

The handymax bulk carrier had loaded steel pipes and steel coils in Asia to be discharged in North America. Before loading, all holds had been swept with brooms, washed with seawater, and then rinsed twice with fresh water. A hatch cover test (hose & chalk) was carried out at the loading port and the holds were accepted for loading. The last three cargoes were potash, sugar and palm kernel in bulk.

Damage on loading

During loading there had been some intermittent rain but according to the crew the cargo hatch covers had then been closed and the loading had been stopped. The pre-loading inspection highlighted that some of the pipes were loaded in a partially dented condition and were rust stained. Furthermore, a few steel coils were noted to have physical damage, and the galvanizing of the outer covers had been affected by oxidation marks. There were also broad rust marks on the port side tank top.

Lumber dunnage, steel straps and wires were used to secure the cargo in the holds. Bundled steel pipes were wrapped with polypropylene sheets and tightly bound with steel bands. However, the ends were exposed. When the loading was completed, marine tape was used across the cross joint seams to prevent water from entering.

Heavy weather

During the vessel's voyage over the Pacific it encountered heavy weather at Beaufort scale 10 with green seas covering the deck and cargo hatches. After the heavy weather the crew found that the cargo had shifted. To secure the cargo the crew used additional timber dunnage, but it was to no avail.

Poor ventilation

In the discharge port many pipes were found to have white rust or zinc hydroxide (galvanizing affected by oxidation marks) and red rust on the exposed ends. Zinc hydroxide is the white or grey rust deposit formed by accelerated corrosion of the zinc coating when closely-packed, recently galvanized articles, are stored or shipped under damp and poorly ventilated conditions.

The vessel had both natural and mechanical ventilation, but this had not been used for a month because of the heavy weather.

Damage

A sliver nitrate test was carried out and it came out positive. Some of the pipes also showed physical damage (i.e. nicked/flattened ends) due to compression. Most of the rusted pipes were on the port side under the cross joints of the bi-folding hatch covers.

Stevedores in one of the discharge ports had placed steel plates over the cargo as a protective barrier in order to use their forklifts to handle the cargo. Because of this some of the pipes were damaged due to the forklift driving directly on top of the pipes. The Master issued a Letter of Protest to the stevedores.

The cargo hatch covers were inspected and found to be in acceptable condition.

The consignee claimed extensive and widespread physical damage including compression dents, crushed and torn ends, bending, broken bundles, as well as rust, corrosion and stains on their cargo.

What can we learn?

- Before sailing it is essential that the crew makes sure that all cargo hatch covers, and other openings are secured properly and are in a weathertight condition.
- To ensure that the cargo hatch cover is secured properly it should be secured in port as per the manufacturer's instructions.
- For complete information on how to maintain the cargo hatch covers, please refer to the manufacturer's manual. It is also important to always use original spare parts.
- Cargo holds are often washed with seawater after unloading, leaving chloride-laden residues behind. The final washing should be done with fresh water. This is especially important if coal, iron ore or phosphates have been loaded previously. If this is not done, ship's sweat containing salt crystals will contaminate the steel and accelerate the development of rust. This can also give a false impression that it is the cargo hatch covers that have been leaking.
- Coils are stowed with the coil eye in a horizontal position. This is done for ease of handling and to minimise surface damage. Coil stowage crucially depends on the correct location of the lower layer of coils, with dunnage used as necessary to avoid damage to the tank top (or supporting structure) and the outer bulkhead. Comprehensive guidance on dunnage placement is given in the IMO's Assembly Resolution A.714 (17), 1991 Code of Safe Practice for Cargo Stowage and Securing (CSS Code), as amended. The stowage of steel coils is quite complex, and guidance should be sought when in doubt.
- The dunnage utilised must be suitably dry to avoid transferring moisture to the product and to the hold's atmosphere. The dunnage must also be phytosanitary-certified and approved to ensure the wood is pest free. Without this certification, the vessel may be banned from offloading cargo in some territories. Hardwood dunnage is preferred to avoid crushing during the voyage and consequential cargo damage.
- Steel coils must be anchored by wooden wedges (dry wood), which are nailed in position to the supporting dunnage board; the wedges are positioned to stop coils moving during rough seas. A centre coil, known as the locking coil, is positioned and secured by steel straps to the coils immediately below.
- If defects/abnormalities are observed during the pre-loading and loading operations e.g. evidence of damaged straps, unwinding or telescoping, damage to packaging, then the bills of lading should be claused.
- Even if the charterer is responsible for loading the cargo, the Master is responsible for ensuring that the vessel is seaworthy before departure.
- To minimise the impact of heavy weather and the likelihood of excessive green seas on deck, corrective action, such as reducing speed or altering course, should be taken.
- Weather routeing is recommended as this not only provides vessels with the option of avoiding heavy weather, but also ensures that the vessel gets new, updated ETAs for the discharge port. This helps the crew on board the vessel, shoreside personnel, and cargo owners, to plan accordingly.

1.14 Steel: Concrete steel pipes damaged due to poor loading and unloading procedures

The vessel had loaded a cargo of concrete-coated pipes. Some of the pipes had been stored in the port without any cover, there was damage to the cement coating, rust, scratches, broken and missing strapping bands, so the Master claused the bill of lading.

Lack of protection

During loading, some of the pipes had no protection towards the bulkhead. There was also a lack of dunnage between the different layers of pipes.

In the discharge port the surveyor claimed that the pipes had been further damaged during the voyage. Some pipes were also damaged during discharge as they hit the ground and were dented as a result of carelessness by the stevedores. It was found that stevedores did not use proper dunnage and did not protect the pipes from touching the ground.

The cargo had damaged edges and barrels, cement chipped off, cracked sockets and other damage. The pipes with damaged edges and cement chipped off could be repaired but the pipes with compressed barrels and cracked sockets could not.

In the storage area the pipes had no proper dunnage or cover.

What can we learn?

- Before loading commences the Chief Officer should discuss the vessel's cargo securing manual with the stevedores and what is required for the specific cargo being loaded.
- A good preventive measure is to have a pre-loading meeting with the crew and stevedores before loading begins.
- It is important that the manager updates the CSM (Cargo Securing Manual) with any new securing requirement.
- Review the stowage plan prior to loading.
- A pre-loading survey is always recommended. A detailed pre-loading report should be produced showing the extent of any exposure to rain/sea spray, together with photos highlighting the cargo's condition during transporting the steel to the wharf, including rust observations and any steel distortion e.g. bent bars, bruised coils and damaged packaging.
- When cargo is already present at the wharf, key observations must include all evidence of rusted steel with silver nitrate tests to verify any exposure to sea water/spray, any damage to products stacked at the wharf including, bent bars, loss of strapping/unwinding on steel coils, extent of telescoping in the coil centre and loose outer laps on the coils, damage to coil edges and comments on the effectiveness of any covering for protecting cargo at the wharf.
- Ensure bills of lading are claused, relating to defects/abnormalities observed during the pre-loading and loading operations e.g. evidence of damaged straps, unwinding or telescoping and damage to packaging.

1.15 Urea: Caking of urea at the discharge port

A large cargo of urea was found to be 'caked' when it was being discharged in Africa. However, the cargo was discharged normally by grab etc. There were some lumps that remained in the urea when it was discharged. Direct bagging was employed on the dockside. There was not a grid on the hoppers for the packing, so part of the urea was discharged in bulk to a dockside warehouse for manual packing.

A cargo expert attended but by the time he arrived the urea had all been discharged and the ship was under arrest for the quality of the urea, specifically the nitrogen content, and for caking.

Local laboratory sampling

Tripartite samples had been obtained during an inspection by the interested parties and these had been submitted to two local laboratories. They had been analysed for nitrogen, biuret (an unavoidable chemical produced during the manufacture of the urea) and water (there will always be some remaining from manufacture – more can be accumulated during subsequent storage/transport).

Urea should contain at least 46% N. The calculated 'Missing %' was calculated from the nitrogen analyses achieved.

The stock was examined and there was no sign of anything other than urea present; all the cargo was pure white and the appearance of the prills (small pellets) looked normal. Any contaminant must therefore have been visually identical to the urea - pure white prills - but containing zero nitrogen to have reduced the nitrogen content to the observed levels.

Fines

Some of the samples were analysed for the percentage of fines (below 1mm). Results ranged from 7.0% to 17.1% with an average of 12.2% - the specification was a maximum of 10%

	LAB 1	LAB 1	LAB 1	LAB 2	LAB 2	LAB 2
	Hatch 3	Hatch 4	Hatch 3	Hatch 4	Hatch 3	Hatch 4
N analysis	40.92	44.37	41.09	44.29	40.99	44.30
% Biuret	0.89	0.91	0.90	0.93	0.89	0.91
% H_2O	1.82	0.75	1.06	0.8	1.67	0.76
Calculated 'Missing %'	10.38	4.06	10.78	4.18	10.38	4.20

Further laboratory testing

Further tripartite sampling had been carried out by the parties during discharge by dropping a grabful of urea onto the deck. Three surveyors then took samples from the load. The operation was repeated five times for three of the five holds. Samples were sent to an internationally recognised laboratory in England for analysis.

- All analysis results for nitrogen were in specification, exceeding the minimum nitrogen content. The local analyses above, were therefore highly suspect.

- The global average for moisture content was 0.38% - much lower than the local analysis result and well within specification.

- The percentage of fines was highly variable even for samples taken from the same grabful. However, the global average for fines was 8.9% and the specification was satisfied.

The arrest of the ship was lifted, and no further claim was made.

What can we learn?

- This case highlights the importance of good quality sampling and analysis in relation to quality disputes.

- Samples should ideally be taken during loading. The sampling procedure should follow local or international standards and should be documented with a Sampling Report.

- If a portion of the sample from the sampler after loading is provided, then preserve it for possible future analysis. Store it in a cool dry place away from heat and out of direct sunlight.

- If the urea becomes lumpy as discharge proceeds, with uniform lumps becoming harder at greater depth, then this is caused by ‘caking’. Caking is caused by a combination of many factors but is NOT caused by any fault of the vessel. Caking of urea can easily be distinguished from lumps caused by water-ingress by an expert when provided with a suitable photographic record. Caking is NOT associated with water ingress. It is strongly recommended that there are suitable photographs taken and that expert advice is sought as soon as possible

1.16 Urea: Contamination

During discharge of a urea cargo, 'stripes' of dirty urea could be seen. Urea should be pure white. The contamination was believed to have been caused by using dirty wagons to transfer the urea to the ship.

Fertilizer grade vs industrial use

The cargo receiver required the urea for industrial use – the manufacture of urea-formaldehyde resin, which is used, for example, in the manufacture of white articles such as electrical light switches. The cargo receiver blamed the vessel for permitting the loading of contaminated urea (even though the vessel was not responsible for the cleanliness of the delivery wagons).

There was a long discussion between an expert and the cargo receivers, where it was highlighted that the vessel had followed procedures that were applicable for fertiliser grade urea rather than the more detailed cleanliness requirements that would be appropriate for their industrial grade.

Considerations with contamination

Other types of contamination of urea cargo have included contamination with foreign materials (coal, grain etc. from previous cargoes). If such contamination is observed during loading, there are several options. An obvious point to consider is to ask the ultimate cargo receivers "does this matter?" – appropriate measures can then be readily identified. A Letter of Indemnity could be appropriate.

At discharge port

If the contamination is only observed at the discharge port, it may still be acceptable to the cargo receivers. Contamination that is localised is probably due to inadequate cleaning from previous cargo – however, in virtually every case the holds would have been inspected prior to loading. Other sources of contamination might be the loading equipment or contamination of the urea during previous transport/storage or on the quayside.

Prior to loading

Contamination that is spread throughout the cargo is probably introduced from the urea prior to loading – it is very difficult to apportion blame in such cases and each must be treated on its merit.

Grains

Contamination with grain can be difficult to resolve. In some instances, entire cargoes have been sieved in order to remove maize kernels. Removal of wheat grains is not possible by sieving because they are a similar size to the urea and the cargo may have to be sold to a less-discerning customer.

What can we learn?

- Before loading a specification will have been agreed between the various parties. If no specification has been provided to the vessel, then it should be requested. If a specification is not provided, then this should be recorded.
- Urea is usually pure white. This means that any coloured contamination will be obvious. It is therefore particularly important to remove any traces of previous cargo especially grain or sulphur. Only a few grains of corn or a few granules of sulphur have given rise to customer complaints. Normal inspection of the holds should pick up such problems. Small quantities of contamination are relatively unimportant for fertiliser use but industrial customers need to have urea without contamination.
- Samples should ideally be taken during loading. The sampling procedure should follow local or international standards and should be documented with a Sampling Report.
- Check loading equipment for cleanliness prior to use. Do not load contaminated spillage and dispose of contaminated urea safely in line with local regulations.


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1.17 Explosion caused by fumigation

A bulk carrier had loaded yellow corn in all cargo holds up to the hatch coamings. After the loading was complete, fumigation technicians came on board and fumigated the cargo with fumitoxin pellets.

As per the cargo documentation, the fumigation pellets were required to be applied subsurface. In this instance the technicians poured the pellets from flasks while walking on the hatch coamings or hatch covers. This work took a little more than an hour and afterwards all the cargo hatches were closed and the vessel sailed.

A series of explosions

A couple of hours later an explosion occurred in one of the holds. The crew noted that the hatch covers had moved slightly and blue gray smoke was seen coming from under the edges. About an hour later another explosion occurred in a second hold, and a couple of minutes later an explosion occurred a third. There were explosions in the remaining holds shortly afterwards.

Cause

Fumitoxin pellets and similar fumigants are made up of around 55% aluminium phosphide which reacts with water to produce phosphine, an extremely toxic and effective fumigant. Phosphine gas will form an explosive mixture when mixed with air at a concentration exceeding around 1.8% to 2% by volume (the lower flammable limit). The concentration of phosphine in the air in each of the holds exceeded this lower flammable limit.

The fumigant pellets in each hold had not been distributed across the entire cargo surface, or applied to the subsurface, but had been applied by simply pouring the pellets on top of the cargo. This method of application had permitted the accumulation of the pellets in limited areas and promoted a relatively rapid reaction of the pellets with moisture, generating concentrations of phosphine gas above the lower flammable limit, which lead to the explosions.

What can we learn?

- The manager should provide training to the crew to ensure that the crew is aware of the requirements and procedures for the fumigation operation. The crew need to ensure that the fumigation pellets are distributed as per the cargo documents.

- Agricultural products in bulk may be fumigated in ships' holds to prevent insect infestation. Solid aluminium phosphide (or similar) is often used for fumigation. Aluminium phosphide reacts with water vapour (humidity) in air to produce phosphine, a toxic and flammable gas, which kills insects. Heat is also given off during the reaction. The solid fumigant may be applied in fabric 'socks' or as pellets on the surface, just before closing holds. Holds are then kept closed for a period before ventilating. People must keep out of holds that are being fumigated due to the toxic fumigant.

- If there is an excessive amount of fumigant in one place, or if the fumigant is in contact with liquid water e.g. from sweating or condensation, then the fumigant can react too quickly. This can evolve excessive heat and lead to ignition of cargo and/or packaging such as bags or paper placed over the top of the cargo. Under certain conditions the fumigant gas itself may ignite, producing an explosion. It is important that fumigant is applied according to the correct instructions. As holds are always un-ventilated for a time after fumigation, there may be a risk of excessive condensation, which can produce sweating or dripping. This can lead to cargo damage as well as the fire and explosion risks mentioned above. The weather conditions and cargo conditions, such as moisture content, therefore need to be considered properly before fumigation, which is often carried out by specialist companies.

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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