The Swedish Club

Bulker focus

Carriage of grains and soya beans

2023

LOSS PREVENTION ESSENTIALS

Maintain clear and accurate records and documentation of each stage of the voyage from loading through to discharge. Keep detailed and accurate logs and obtain photographs.

•

It is recommended that a local surveyor is appointed prior to loading and during discharge.

•

The charterparty will indicate that the holds must be at 'grain clean' standard prior to the commencement of loading. If the vessel's holds are incorrectly accepted, and the cargo loaded, claims may be lodged following discharge.

•

It is prudent for a hatch cover test to be undertaken prior to loading. This can be carried out using an ultrasound device or hose test.

•

Avoid heavy weather. Use weather routeing.

•

We recommend carrying out a draft survey before opening the cargo hatches. Do not sign any draft survey report with incorrect figures. In such cases, we strongly recommend adding a remark.

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If the hatches were sealed at the loading port, arrange for an unsealing survey before the hatches are opened. Make sure that the unsealing certificate is signed by the receivers.

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Keep detailed records of the discharge process. A surveyor may be appointed to monitor the discharge operations and to control the weighing of discharged cargo.

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Before authorising the vessel's agent to sign statements of shortage or any such document on the vessel's behalf, discuss this with your owner or the Club's correspondent.

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Upon completion of discharge, obtain a statement stating that all cargo has been discharged and that the holds are empty.

•

Keep a close dialogue with the charterers/cargo receivers. In most cases, the charterers are responsible for the discharge of the vessel. Remember that the stevedores are effectively the charterers' employees.

•

All discrepancies between the bill of lading and cargo quantity must be noted and shown at the discharge port to avoid a shortage claim.

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1. Introduction

In this guide we focus on cargo claims in relation to grains and soya beans. To be included in the statistics the claims must have generated a cost of at least USD 5,000 and have been made between 2018 and 2022.

The Club has reviewed around 200 bulk carrier claims and carried out analysis on the statistics.

The publication includes sections that provide guidance on carrying out fumigation and ventilation effectively in addition to a review of customs' fines. We have also included a number of case studies which illustrate the importance of following loss prevention advice.

2. Grains

The loading, carriage and discharge of bulk grain and oilseed cargoes present numerous challenges. There is a range of considerations for the crew to consider prior to and during the carriage of bulk grain or oilseeds. An understanding of the common issues experienced during carriage of these cargoes and ways to avoid them may well assist in preventing cargo damage and claims.

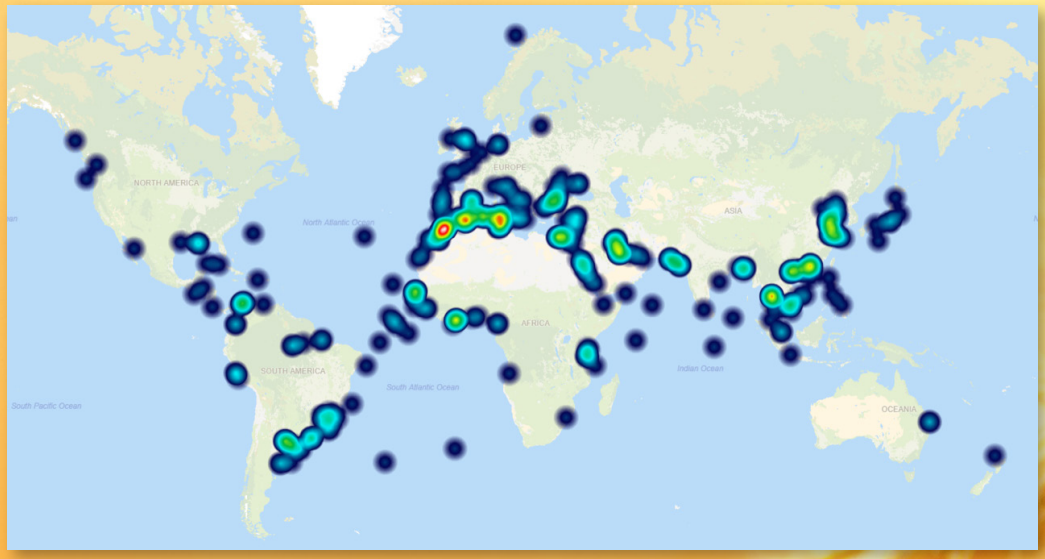
2.1. Statistics

GRAPH 1

Grain cargo - geographical location of claims

2018-2022

As per 02/01/2023



A high density of claims is indicated in red.

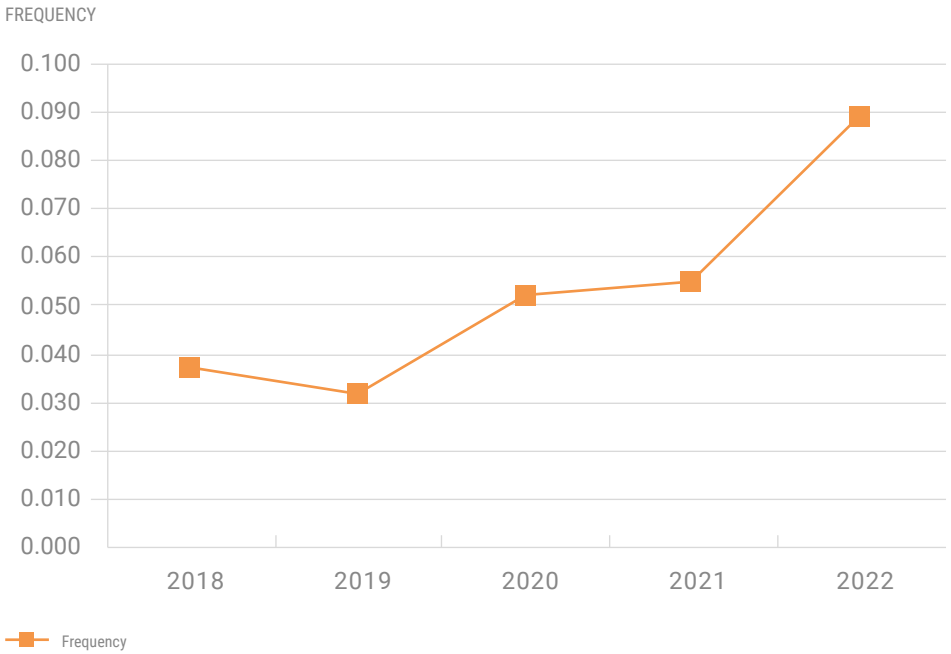
GRAPH 2

Grain cargo - frequency per year

Claim cost: USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



The graph shows that the average frequency for the five-year period is 0.056, which means that 5.6% of all bulk carriers have made a grain claim. Since 2019 there has been a steady increase in frequency of claims.

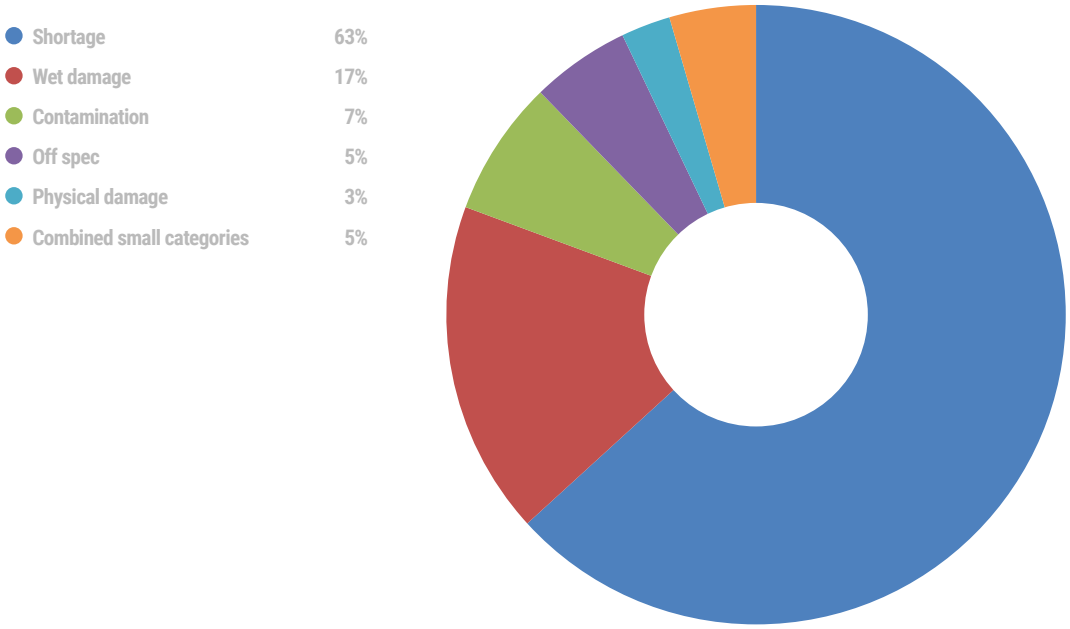
GRAPH 3

Grain cargo - type of claim, number of claims

Claim cost: USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



During the five year period of the report the most common claims were for shortage (63%) especially during discharge (68%) and these were seen most commonly in North Africa and China.

About 70% of shortage claims occur due to discrepancies between the vessel's figures and shore figures. In this five-year period there were few claims in China until 2021, but since then we have seen a steady increase in the region. Over the entire five-year period, however, most claims were in North Africa *(see page 13)*.

The increase of claims in China over the last couple of years can be related to the pandemic. The severe lockdowns that were seen in many cases delayed the vessel. They also made it difficult for surveyors to attend the vessel for inspection. Crew and stevedores were also more hesitant to interact with each other because of the risk of becoming infected. This led to the crew not being able to verify the cargo operation and taking draft figures.

We see a similar picture with soya bean claims *(see page 17)*.

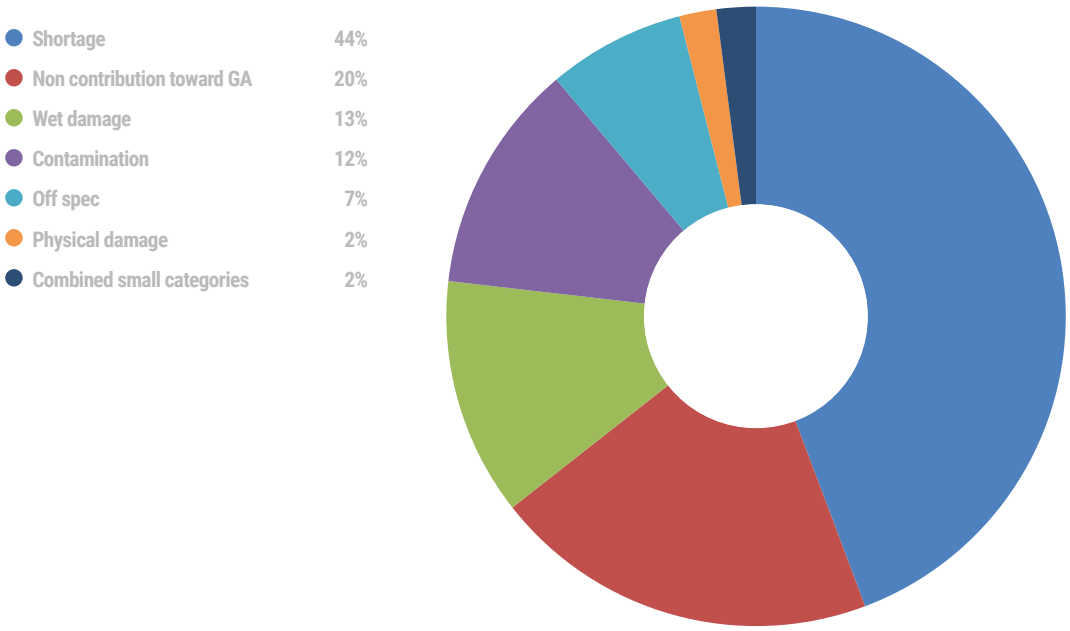
GRAPH 4

Grain cargo - type of claim, cost of claims

Claim cost: USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



- Shortage contributes to 44% of the total claims cost, with an average claim cost of USD 35,000. Although shortage claims appear to be of relatively low value, the aggregate cost of these claims is, in fact, significant as they are common.
- Non contribution towards GA contributions make up 20% of the total cost, with a high average claim cost USD 800,000. (This type of claim takes place when the cargo owner does not contribute to GA, for example, during a salvage operation.) Fortunately these kinds of claims are few.
- Wet damage makes up 13% of the total cost, with an average claim cost of USD 37,000.

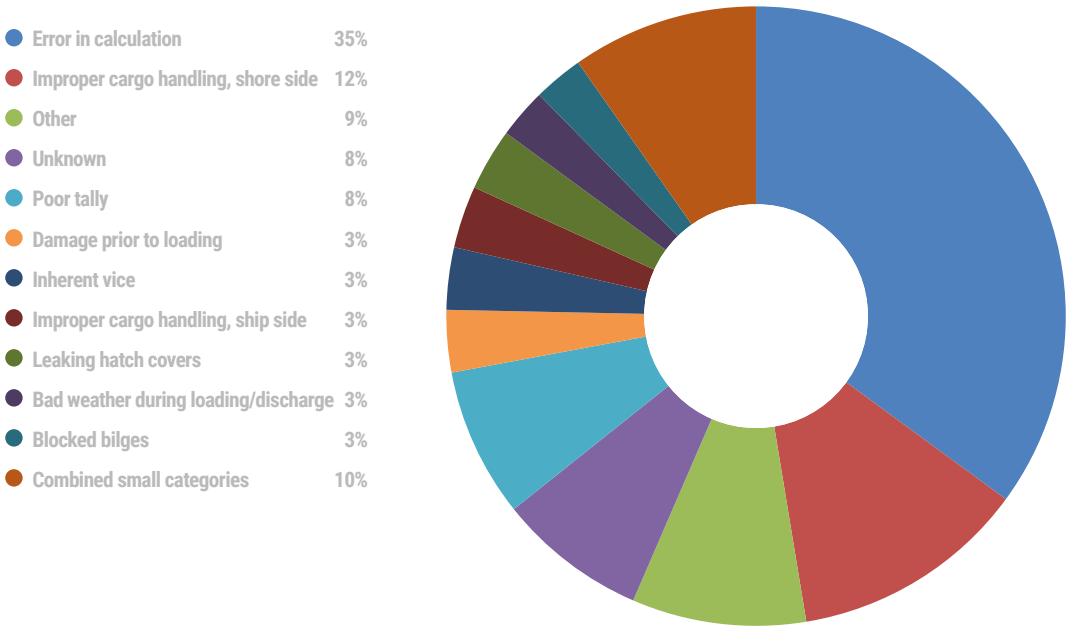
GRAPH 5

Grain cargo - cause of damage, number of claims

Claim cost : USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



- The most common cause of damage is an error in calculation which is effectively a shortage claim. This category makes up 35% of total claims and more than 80% of incidents have happened at the discharge port.
- The second most common cause is improper cargo handling on shore side contributing to 12% of claims. This is equally likely to happen at either the discharge port or loading port.

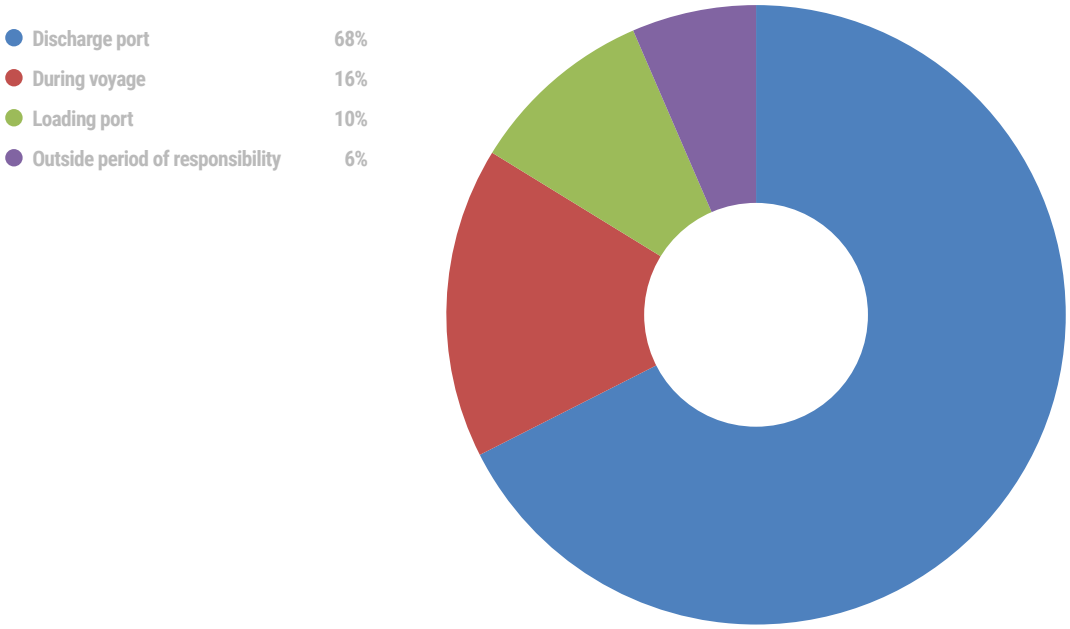
GRAPH 6

Grain cargo - where the claim occurred

Claim cost: USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



It can be seen that most claims occur at the discharge port. These contribute to 68% of all claims and are mainly driven by shortage. Claims during the voyage account for 16% of these, and only 10% of claims take place in the loading port.

In the event of damage to cargo being discovered at discharge it is important that the location of the damaged cargo in the hold or holds is accurately recorded. This will assist in determining the cause of damage. The crew should closely monitor discharge and any segregation activities. A local surveyor should be appointed to document cargo condition, inspect the damage and, where relevant, obtain a cargo temperature profile throughout discharge.

A sampling superintendent should also be appointed to take representative samples of the grain during discharge. Ideally, the sampling should be performed on a joint basis with other interested parties. The representative samples obtained should represent both the cargo as a whole and also for any segregated categories. This means that additional representative samples should be obtained for cargo considered sound and for cargo considered damaged.

2.2. Issues in specific countries

- In Argentina, mate's receipts are customarily presented to the Master by the shippers. The exporter (or importer when applicable) has the right to choose the weighing method for fiscal/ customs purposes. In the case of bulk agricultural exports, the method chosen will invariably be the use of shore scales. It is not unusual to have discrepancies between the shipper's figures based on shore scales and draft surveys. In general, whenever the shortage per draft surveys exceeds 0.5%, we recommend that the Master clauses the mate's receipts (and bills of lading thereafter) with ship's figures as the only way to be protected from shortage claims at the discharge port.
- In Tunisia and Algeria shortage claims often arise as a consequence of receivers not accepting the established trade allowance of 0.5% of the bill of lading quantity.
- Draft survey figures are not recognised in Algeria. In the event of a shortage, only the shore scale figures will be recognised by the local receivers and calculation of the claims will be on that basis.
- Any errors in manifests regarding quantity, or description of cargo are subject to customs fines in Tunisia. If you experience spillage, record details of the spillage and check the calibration and accuracy of the shore scale. Take photographs of the cargo spillage from the grabs, hoppers and trucks.

3. Soya beans

The loading, carriage and discharge of soya beans presents numerous challenges.

The global trade of soya beans has undergone continued expansion in recent times in part due to the increasing demand in China, the largest soya bean importer, for animal feed. The largest soya bean exporters are Brazil and USA which account for around 80% of the global export market.

3.1. Statistics

GRAPH 7

Soya bean cargo - geographical location of claims

2018-2022

As per 02/01/2023

The majority of claims have been recorded during discharge in China, with a number of claims from Europe

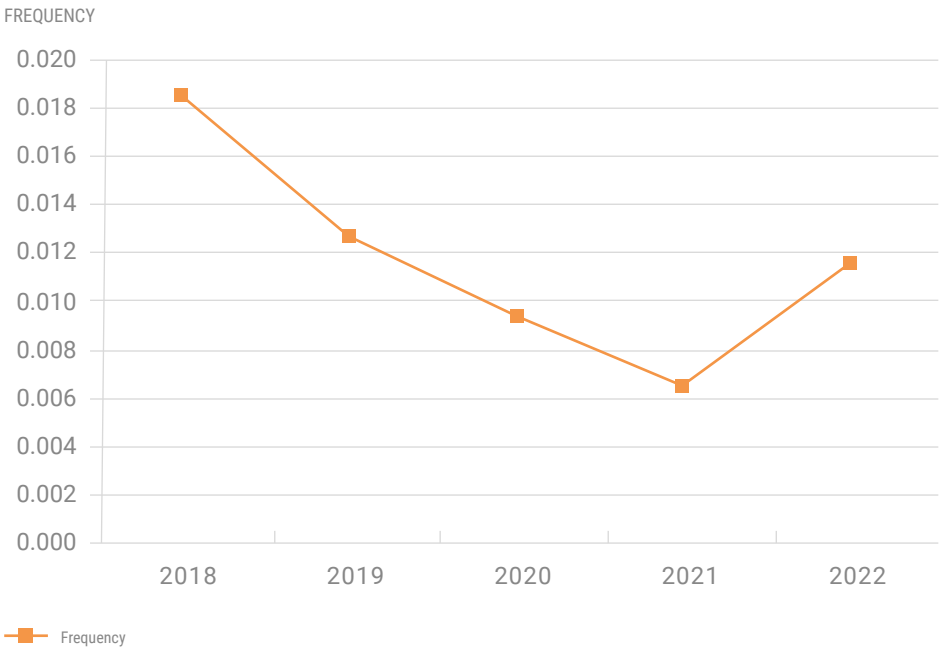
.GRAPH 8

Soya beans - frequency per year

Claim cost: USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



The graph shows that the frequency for the five-year period is 0.011 which means that 1.1% of all bulk carriers have had a soya bean claim. The average claim cost is USD 54,000.

The impact of the pandemic can be seen, with vessels forced to stay at anchor for extensive periods. These delays can lead to heat damage which is a significant concern with soya bean cargoes.

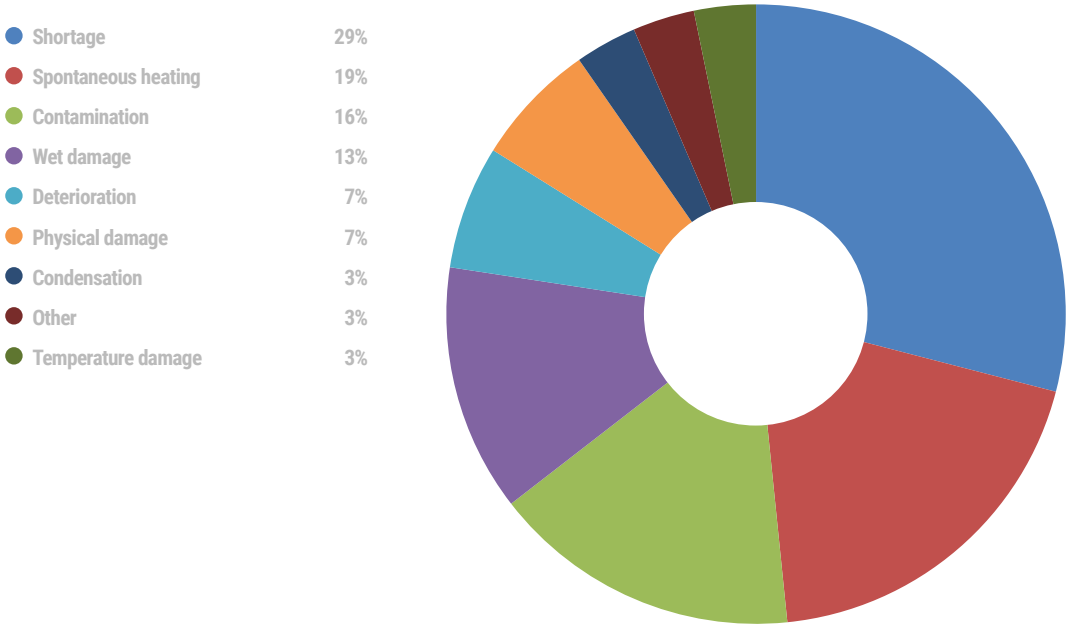
GRAPH 9

Soya beans - type of claim, number of claims

Claim cost : USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



The most common claim is for shortage at 29%, followed by spontaneous heating at 19% and contamination at 16%.

When compared with grains, shortage makes up a considerably smaller percentage of claims (29% vs 44%). This is partly a trading issue (*see section 2.2*) but in addition the statistics have been influenced by COVID delays.

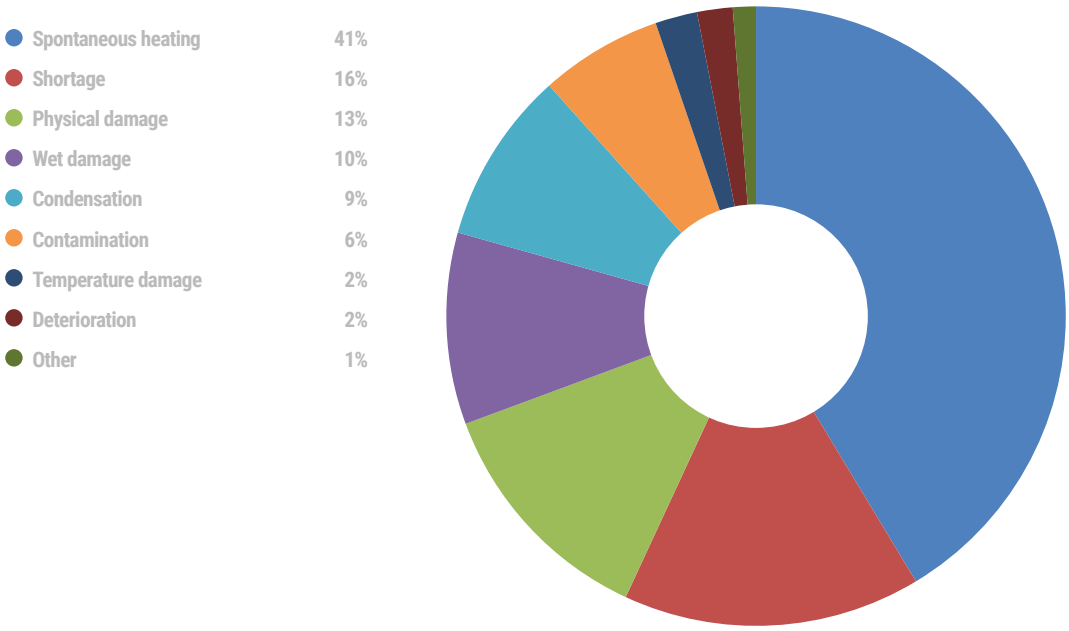
GRAPH 10

Soya beans - type of claim, cost of claims

Claim cost: USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



- Spontaneous heating accounts for 41% of the Club's total claims cost in this category, with an average claim cost of USD 115,000.
- Shortage makes up 16% of the total cost, with an average claim cost of USD 29,000.
- Physical damage contributes to 13% of the total cost, with an average claim cost of USD 103,000.

The degree to which self-heating or spontaneous heating manifests itself within the cargo is influenced by the moisture content and temperature of the cargo at loading and the duration of the voyage. In some cases, parcels of cargo with a high moisture content will begin to develop mould, further heating the cargo. If the entire cargo has an inherently high moisture content, the risk of mould growth and self-heating increases significantly.

The Master and Chief Engineer should consider the location of the heated fuel oil tanks (FOTs) prior to loading and, if possible, stow cargo away from them. If the cargo is stowed adjacent to the FOTs, the Chief Engineer should be instructed to ensure that fuel oil is heated to the minimum pumpable temperature. A record of this instruction, as well as keeping concise fuel oil temperature records, could prove valuable in defending a claim for over-heating of the fuel oil, and consequent damage.

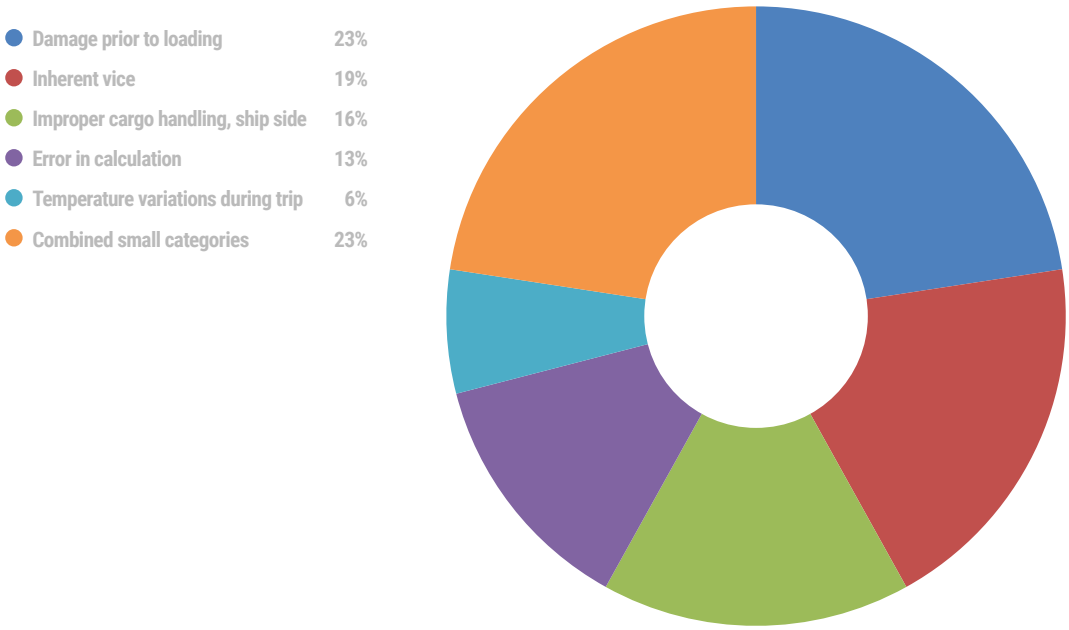
GRAPH 11

Soya beans - cause of damage, number of claims

Claim cost: USD 5,000 – 3,000,000

2018-2022

As per 02/01/2023



- The most common cause of damage claim is is damage prior to loading, at 23% of total claims. When considering the damage that leads to these claims, 43% of these claims were observed in the loading port, 29% during the voyage, and only 14% at the discharge port.
- The second most common cause is inherent vice, at 19%. This manifests at the discharge port 50% of the time and during the voyage at 33%.
- The third cause is improper cargo handling ship side, at 16%. This category of claim relates to heating damage and wet damage, often caused by rain during loading and discharge.

To protect against cargo being damaged prior to loading it is good practice to take photographs of the cargo and during loading operations. The photographs should include an overview of how the cargo was loaded, the cargo in the holds during loading and, where possible, close-up photographs of the cargo itself.

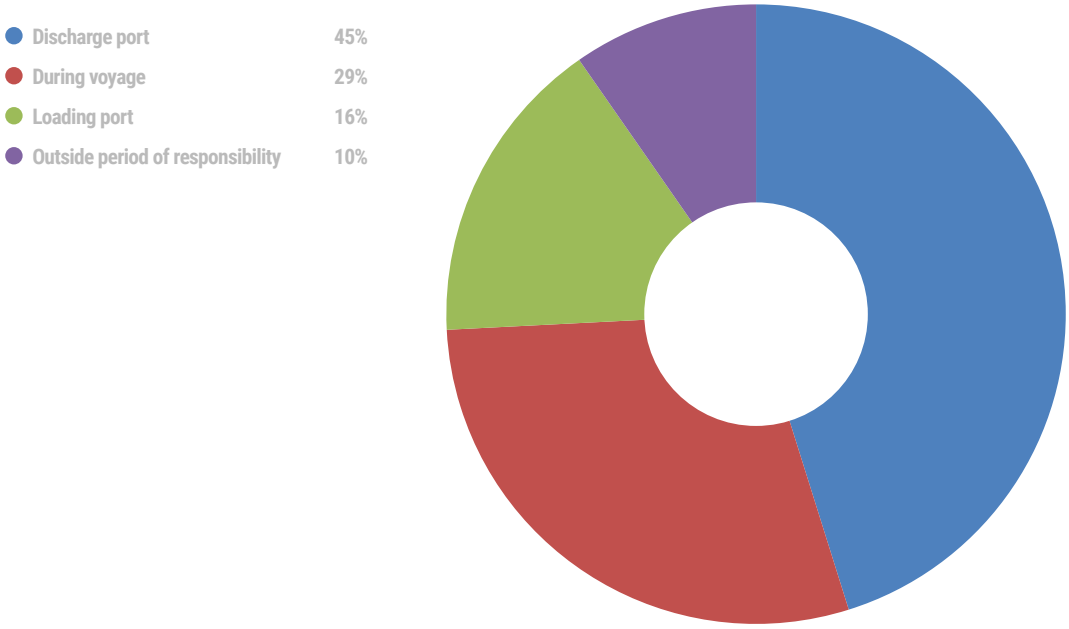
A letter of protest should be issued to all concerned parties if any deteriorated, mouldy or wet cargo is identified. The Master has the right to reject the cargo for loading if it is in visibly poor condition. In the event of a cargo quality issue being suspected, it is also recommended that the cargo is representatively sampled according to the sampling methods of the governing body specified in the commercial contract.


NO SMOKING

GRAPH 12

Soya beans - where did the claim occur?
Claim cost: USD 5,000 – 3,000,000,
2018-2022

As per 02/01/2023



Most claims have been recorded at the discharge port at 45%, with 29% occurring during the voyage and only 16% in the loading port.

During the voyage ship's sweat and cargo sweat are types of condensation that form within the hold due to changes in environmental conditions. This condensation can result in a localised increase in the cargo moisture content, which places the affected cargo at increased risk of deterioration and mould growth and an associated rise in temperature *(see section 6)*.

In the event of damage at discharge it is important that the position of damage in the hold(s) is accurately recorded - for instance the location, depth/height above tank top, and area. This will assist in determining the cause of damage. The crew should closely monitor discharge and any segregation activities. A local surveyor should be appointed to document cargo condition, inspect the damage and, where relevant, obtain a cargo temperature profile throughout discharge.

4. Advice

4.1. Hold cleaning

Following the discharge of the vessel's previous cargo, it is common practice for the holds to be cleaned.

For most dry agricultural cargoes, such as bulk grain, oilseeds and soya beans, the charterparty will indicate that the holds must be at 'grain clean' standard prior to the commencement of loading. The term 'grain clean' and its interpretation by surveyors can vary from country to country and is not clearly defined. The definitions and strictures to which hold cleanliness grades are applied varies. It is known that in some countries, such as the USA, Canada and Australia, the cleanliness standards are applied quite rigidly. Failure to comply with these requirements can result in the rejection of the vessel for loading by the shipper.

As an example, vessels loading grain or soya beans in the USA will undergo a stowage examination by United States Department of Agriculture (USDA) Federal Grain Inspection Service (FGIS) to ensure the cargo space is clean. The purpose of the examination is defined by the USDA as:

'A stowage examination is a service performed by official personnel or licensed co-operators who visually inspect an identified carrier or container and determine if the stowage areas are clean; dry; free of infestation, rodents, toxic substances and foreign odour, and otherwise be suitable to store or carry bulk or sacked grain, rice, beans, peas, lentils or processed commodities.'

The USDA directive provides definitions of standards and requirements for rust scale, dryness and infestation or contamination. These include the maximum permitted surface area of rust and rust scale.

Failure to comply with hold cleanliness requirements can result in the rejection of the vessel for loading by the shipper. Alternatively, if the vessel's holds are incorrectly accepted, and the cargo loaded, claims may be lodged following discharge if it is discovered that there was contamination with rust or previous cargo residue.

4.2. Hatch cover test

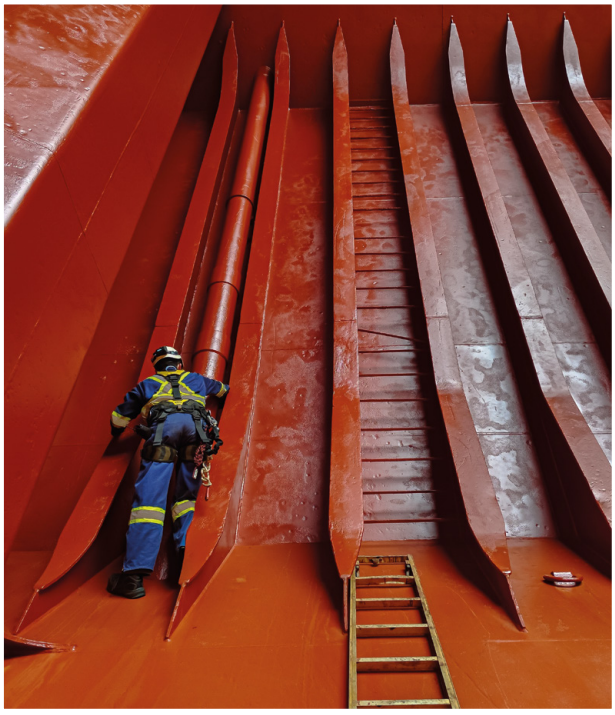
To mitigate the risk of a wet damage claim it is prudent for a hatch cover test to be undertaken before loading. This can be carried out using an ultrasound device or hose test. These tests are important as they enable the crew to make any necessary repairs to the hatch covers prior to the cargo being loaded. Furthermore, the test provides good supporting evidence against accusations of water ingress through the hatch covers in the event of a wet damage cargo claim. In the event of heavy weather a sea protest detailing the weather event with photographs may also assist in the defence of a claim.

4.3. Wetting at loading

If water ingress occurs at loading, wetted cargo must be discharged. Failure to discharge wetted cargo at load port is likely to lead to cargo claims at the discharge port due to visible mould growth. A letter of protest should be issued to all concerned parties if any deteriorated, mouldy or wet cargo is identified.

4.4. Appoint a surveyor prior to loading

It is recommended that a local surveyor is appointed prior to loading. The surveyor can take part in inspections during which particular attention should be paid to the bilges, ensuring they are clean and dry as these are a frequent source of wet damage claims.



For soya beans specifically, the surveyor should record the cargo temperature at regular intervals using a calibrated temperature probe and also keep a record of colour and odour of the soya beans throughout loading.

The Master has the right to reject the cargo for loading if it is in visibly poor condition. In the event a cargo quality issue may be suspected, it is also recommended that the cargo is representatively sampled.

4.5. Record keeping and review

The Master should also ensure that the cargo being loaded is suitable for the vessel prior to loading. This will involve carefully reviewing any cargo declarations or certificates.

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 obtaining photographs throughout the voyage.

4.6. Heavy weather

Heavy weather during the voyage can also result in water ingress via hatch covers or open ventilation windows. A sea protest with details of the weather event should be issued on arrival at the

destination. If the vessel has experienced heavy weather a local surveyor should be appointed in the discharge port to document the cargo condition, inspect if there is any damage and, where relevant, obtain a cargo temperature profile throughout discharge.

4.7. Take samples

During discharge if a claim is anticipated, or damage is found, it is recommended that representative samples are obtained during discharge. In every instance, care should be taken to ensure that the most effective and practical segregation method is undertaken of the damaged cargo. The segregated cargo should also be representatively sampled.

4.8. Special advice for soya beans

Soya bean cargoes carried in bulk, along with other agricultural commodities, continue to undergo biological reactions during storage. The soya beans will continue to respire - albeit slowly - consuming oxygen and generating carbon dioxide, water and heat.

4.8.1 Loading

If the Master is unfamiliar with the loading of soya beans then accepted industry guidelines available on board, such as Thomas' Stowage, should be referred to, as these will provide helpful guidance on the safe carriage of the cargo. For soya beans the most helpful information to obtain at loading is details of the cargo moisture content and temperature.

4.8.2 Self-heating

Due to the large quantity of cargo within the holds and the high insulation capacity of such cargoes, the soya bean temperature can slowly increase over time. Self-heating can reach very high temperatures in soya beans - circa 80°C is possible - due to microbiological heating followed by chemical breakdown of oils within the soya bean. Self-heating in soya bean cargoes can negatively affect the quality parameters of the cargo, such as the colour, odour, protein solubility and free fatty acid content of the oil.

This oil content leads to an additional risk of self-heating and there is a greater risk of soya beans self-heating in comparison to cereal grain cargoes. In severe cases of heating the areas in the stow may severely discolour and carbonise.

The only truly effective method to mitigate self-heating is to ensure that the cargo is discharged as soon as possible. Self-heating may continue post-discharge if the cargo is stored in large piles with little ventilation.

5. Customs fines for cargo shortage

Extract from article in Triton no 1, 2022 by Martin Birgersson, Claims Manager, P&I, Team Gothenburg, Simon Williams, Director, Mills & Co. and Chris Hellström, Solicitor, Mills & Co.

Customs authorities around the world frequently issue fines for short/excessive discharge of cargo. The reason for this is often to compensate for the government's loss of customs revenue. For customs authorities, a vessel is an easy target and the fine is often issued to the agent. For that reason the agent will often request a security from owners for potential customs fines.

Customs' figures are commonly based on warehouse tally or shore-scale figures. These figures are determined away from the ship and are, therefore, beyond the control of the carrier. Such figures may count bags of cargo that have been torn after discharge as being short-landed. In some jurisdictions, a 'customs draught survey' may be requested by owners via the agent. Whenever possible, we recommend that such a draught survey is performed.

The liability to compensate cargo interests for shortage and the liability to pay the customs fines, are subject to different rules. This can produce unexpected and unfavourable results. A shipowner may be able to reject the cargo claim in full and yet have an obligation to pay the related customs fines.

A proactive defence against shortage generally starts in the load port with the accurate quantity loaded being inserted into bills of lading issued. Despite this, a customs fine for shortage could be imposed at the discharge port especially where the customs fine is determined by means of shore scale figures/tally, etc.

The second line of defence is the contractual terms of the charterparty. In the case of a time charterparty, it is the choice of the charterers to trade the vessel within the applicable trading limits in the charterparty. That may well include countries that routinely impose customs fines. Please note that the Inter-Club Agreement (ICA) will normally not cover customs fines as not being a cargo claim brought under a contract of carriage. Appropriate wording in the charterparty may be included to make charterers responsible in full for both securing, handling and settling any cargo shortage claims and/or customs fines imposed. Such a bespoke clause may require legal advice as to whether it is appropriate for the charterparty and circumstances and may include clauses dealing with, for example, arrest/detention, counter securities and off-hire. Such clauses may, however, be difficult to incorporate due to commercial considerations.

As an alternative the 'normally included ICA Clause' could be amended to also include customs fines and would require the other party to counter-secure any securities issued. Depending on the other terms this may be a trade-off between recovery in full against a counter-security.

6. Ventilation - a practical guide

Ventilation of bulk cargoes, especially agricultural commodities, is a recurring theme in claims brought against owners. It is therefore important to understand what ventilation is, when it needs to be performed and the common issues associated with improper ventilation.

6.1. Natural ventilation

The most commonly used ventilation on bulk carriers is natural ventilation (as opposed to mechanical ventilation). The hatch covers are usually equipped with a total of four ventilation windows with two windows forward and aft or two windows port and starboard. Natural ventilation is a way of ventilating using the relative wind speed encountered during a voyage.

6.2. The route

A priority for the Master to consider regarding ventilation is the voyage route. A vessel can encounter significant variation in sea water and air temperature during a voyage. Some routes/ environments are more likely to lead to condensation than others.

For example, it is unlikely that significant condensation would happen when a vessel has loaded a cargo in the Mediterranean and is inbound for another Mediterranean port. The voyage is short and usually remains in the same temperature range. On the other hand, a soya bean cargo loaded in the USA or in Brazil in a warm climate and discharged in Northern China at freezing temperatures, is likely to exhibit condensation, as the warm and humid air in the headspace would condense on the steelwork cooled by the external temperature.

6.3. Ship’s sweat

Ship’s sweat can be defined as the consequences from a change in temperature leading to condensation forming on the interior steelwork, which often drips down onto the cargo surface. The condensation forms when the warm humid air in the headspace comes into contact with the relatively cooler steelwork, such as the hatch covers, and then drips back onto the cargo and runs down the sides of the holds, creating a characteristic pattern of damage: the drip lines.

The increase in moisture content of the cargo directly wetted by water dripping creates an environment favourable for mould growth. Mould is alive and its metabolism releases heat into the environment as it grows which in turn creates a favourable environment for self-heating of the cargo. The mould growth exacerbates the rate at which warm moist air is released into the headspace creating a condensation positive feedback loop.

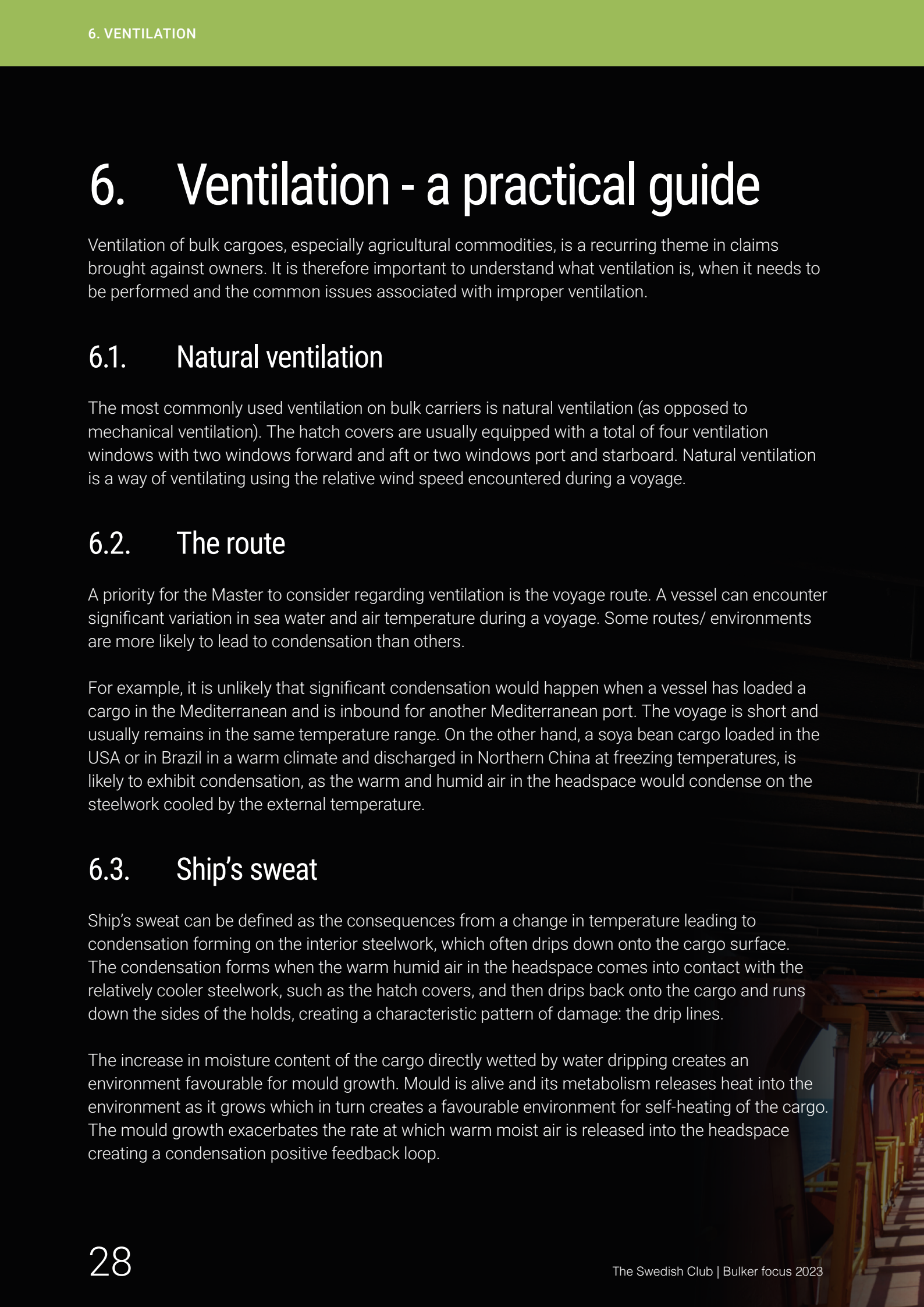


Image (i) - Ship's sweat
(Courtesy CWA)

Image (ii) - Ship's sweat
(Courtesy CWA)

Image (iii) - Ship's sweat and cargo self-heating
(Courtesy CWA)

6.4. Cargo sweat

Cargo sweat occurs under the same principle as ship's sweat: a change in temperature leads to formation of condensation when warm and humid air encounters a colder surface. In this case however, the cooler surface is not the steelwork but the upper layer of the cargo itself. This will occur if a cargo loaded in a cold climate is exposed to warmer air, either due to the hatch covers being opened or incorrect ventilation of the holds. The water vapour present in the introduced ambient air condenses on the cargo surface, which then leads to mould growth and localised heating in the same manner as ship's sweat.

Image (iv) - Cargo sweat
(Courtesy CWA)

6.5. Ventilation advice

The correct ventilation can prevent sweat issues.

Firstly, the carrier and Master should consider whether there are any instructions in the charterparty or in the voyage order. If any instructions are unclear, the Master should prudently clarify the instructions.

There are two rules that the crew can use to determine if ventilation is necessary.

The dew point rule

The dew point rule is the most commonly used rule when dealing with cargo claims. It requires that a cargo hold should be ventilated when the dew point of the outside ambient air is lower than the dew point of the air inside the headspace of the hold.

To apply the dew point rule, the Master and the crew need to monitor the cargo temperature each watch for each hold and use these measurements to calculate the dew point.

The measurements need to be taken in the hold headspace to obtain accurate dry and wet bulb temperatures; this implies that the crew need to have access to the headspace which is not always possible and is not recommended for safety reasons. Furthermore, the wet bulb temperatures need to be measured using a whirling hygrometer, which is rarely used. If the measurement takes too long, the act of the crew entering the hold can cause air to be replaced in the headspace, which may render the measurements invalid.

In practice, crews often obtain dry/wet bulb temperatures from the sounding pipes in the hold or from the access man holes which can lead to inaccurate and non-representative measurements.

The three degree rule

A second rule that can be used to determine if the cargo requires ventilation is the three degree rule: A cargo hold should be ventilated when the outside ambient dry bulb temperature is at least 3°C lower than the cargo temperature.

This method has several practical advantages and is usually recommended instead of the dew point rule as it is easier for the crew to implement. It simply requires comparison of the external ambient temperature with the cargo temperature. Additionally, it is safer, as the crew would be on deck for a reduced amount of time and no measurements from the holds need to be taken.

It is essential, no matter the ventilation rule, to keep a detailed record of the ventilation process as this will provide crucial evidence in case of a claim at the discharge port. The charterparty or voyage orders may contain instructions as to what information and items should be recorded.

The ambient dry and wet bulb temperatures need to be clearly recorded every day at each watch, and the holds' dry and wet bulb temperatures need to be recorded if the dew point rule is used.

These ventilation logs should include any periods when ventilation was impossible due to prevailing sea or weather conditions. It is of the utmost importance that all relevant aspects of weather and sea conditions are fully recorded. It is also recommended that the heated fuel oil tank temperatures during voyage are recorded.

6.6. Conclusion

The key points to consider in relation to ventilation are:

- The voyage route and likely environmental conditions
- The cargo temperature
- Instructions contained in the charterparty or voyage orders
- The ventilation rule to be used
- The maintenance of a detailed ventilation and cargo monitoring record even if ventilation is not carried out

7. Fumigation - a practical guide

Fumigation is a pest control method which uses a gaseous chemical to control pests found in, or on, an agricultural cargo. The fumigant gas is released into a defined space either to suffocate or poison the pests within.

Grains, soya beans and oilseed cargoes are usually fumigated on completion of loading prior to in transit fumigation. Occasionally the cargo may be fumigated ashore prior to loading or on arrival at the destination.

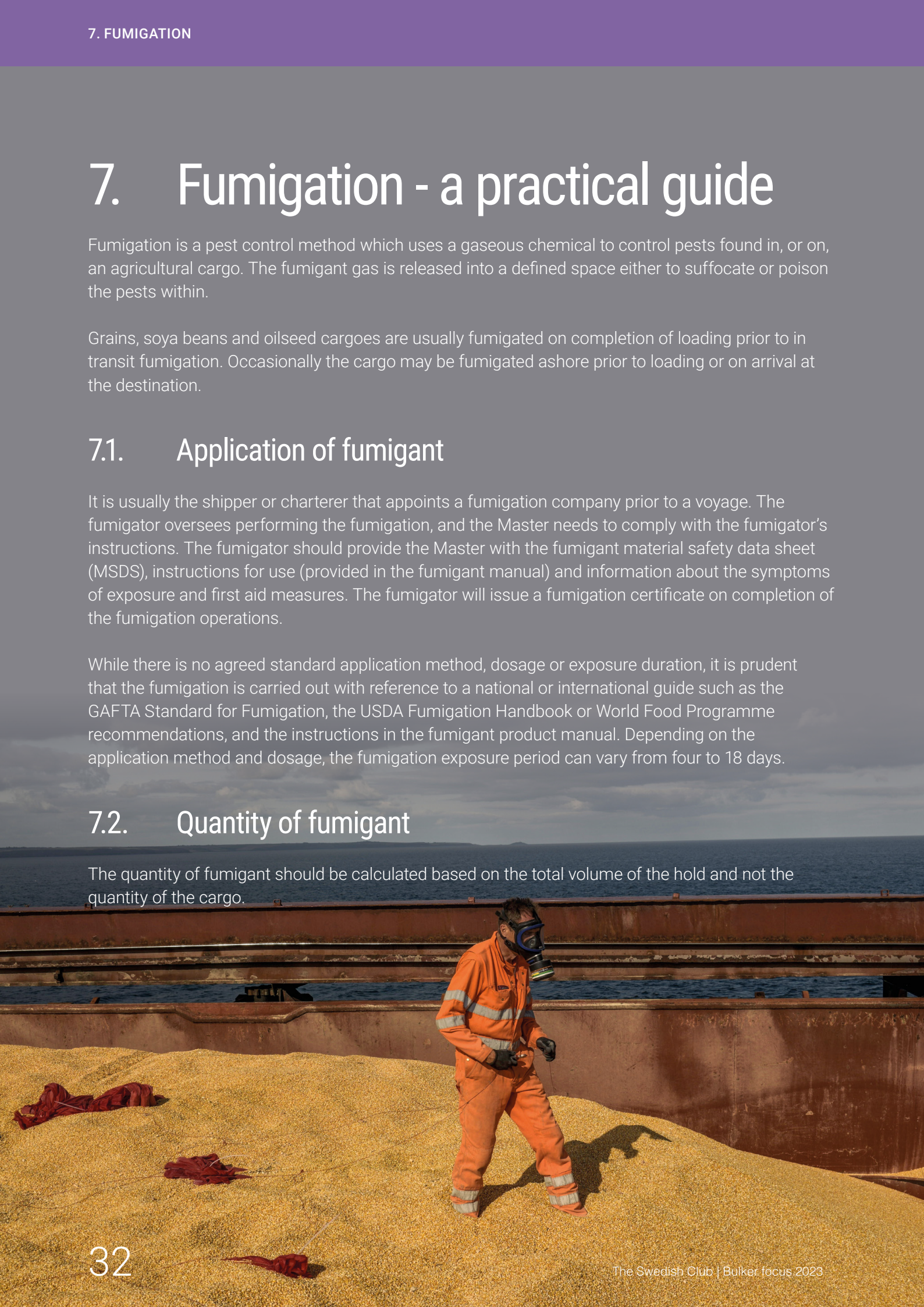
7.1. Application of fumigant

It is usually the shipper or charterer that appoints a fumigation company prior to a voyage. The fumigator oversees performing the fumigation, and the Master needs to comply with the fumigator's instructions. The fumigator should provide the Master with the fumigant material safety data sheet (MSDS), instructions for use (provided in the fumigant manual) and information about the symptoms of exposure and first aid measures. The fumigator will issue a fumigation certificate on completion of the fumigation operations.

While there is no agreed standard application method, dosage or exposure duration, it is prudent that the fumigation is carried out with reference to a national or international guide such as the GAFTA Standard for Fumigation, the USDA Fumigation Handbook or World Food Programme recommendations, and the instructions in the fumigant product manual. Depending on the application method and dosage, the fumigation exposure period can vary from four to 18 days.

7.2. Quantity of fumigant

The quantity of fumigant should be calculated based on the total volume of the hold and not the quantity of the cargo.



7.3. Aluminium phosphide

The most common fumigant used for soya bean cargoes is aluminium phosphide. This reacts with moisture to produce phosphine gas. The standard fumigation exposure period, during which the holds must remain sealed, is not fixed and may vary between 3.5 and 18 days. The most frequently seen fumigation exposure period for bulk soya beans is usually 10 days.

7.4. Methods

A fumigator can choose from several different methods to apply the tablets/pellets to the cargo or hold space. These include surface application, sub-surface application or recirculation. The application method and fumigant dosage are dependent on the depth and volumetric space of the cargo holds. Simply, the deeper the holds the longer an exposure period will be required to ensure that the gas fully penetrates the whole cargo space.

7.5. Fumigation advice

Several issues can arise if a fumigation is not carried out correctly or the crew fails to follow the fumigation instructions.

Crew injury

Phosphine gas is a highly effective toxin and is lethal for human beings. Any crew member exposed to phosphine should be moved to fresh air and provided with oxygen. Sadly, there have been crew fatalities linked to fumigation, and these are often related to gas leaks or entry to fumigated spaces.

Damage to the ship

Upon application, the metal phosphide tablets/pellets react with the moisture in the air. The phosphine gas is spontaneously explosive and flammable with a lower explosive limit (LEL) of 1.79% in air. This means that if the concentration reaches the LEL , either due to application of an incorrect dosage, poor application of fumigant and/or rapid release of phosphine from the tablets/pellets, an explosion can take place within the holds. This is obviously a serious concern for the vessel and the safety of everyone on board.

Damage to the cargo

There are also risks to the cargo itself. These risks can include damage due to fire/explosion or through failure of the fumigation. In the latter case, the fumigation may fail if the concentration of the phosphine gas within the hold is not effective due to incorrect dosage of aluminium phosphide, poor application of the fumigant, leaks from the hatch covers, extremely cold weather and/or too short

an exposure period. In these cases, the fumigant may fail to fully penetrate the cargo for a sufficient period and kill all insect life cycle stages present in the cargo.

To avoid claims at the discharge port that the vessel did not carry out due cargo care through ventilation, the crew should seek clarification regarding the fumigation exposure period and subsequent ventilation instructions from the fumigator, shipper or charterer. In the absence of clear instructions, it is prudent to ventilate the cargo after completing the minimum fumigation exposure period when the conditions are suitable according to a recognised ventilation rule such as the three degree or dew point rules.

7.6. Conclusion

The Master and crew should pay special attention to the following:

- Ensure familiarity with IMO Recommendations on the Safe Use Of Pesticides in Ships Applicable to the Fumigation of Cargo Holds - (MSC.1/Circ.1264).
- Ensure familiarity with the fumigator's instructions for use including the information in the Safety Data Sheet.
- Check that the fumigation application method corresponds to the information provided in the fumigation documents or certificate.
- Ensure that adequate gas detection equipment and gas masks are provided on board, including instructions for use.
- Carry out frequent gas concentration safety checks at all appropriate locations, including accommodation, engine room, working areas and stores adjacent to cargo holds and record readings in the logbook.
- Cargo holds sealed for fumigation should never be opened at sea or entered. If entry is imperative in an emergency, at least two people should enter, wearing adequate protection equipment, assisted by a person outside the space, similarly equipped with self-contained breathing apparatus.
- If it is essential to ventilate a cargo hold or holds, every effort should be made to prevent fumigant from accumulating in accommodation or working areas.
- Before entering fumigated cargo holds at the discharge port, trained personnel from a fumigation company or other authorised people wearing respiratory protection, should carry out careful monitoring of the spaces to ensure the safety of personnel.
- The ship's crew should not handle fumigants and such operations should be carried out only by qualified operators.
- In case of exposure to fumigants, medical advice should be sought immediately. Information on poisoning can be found in the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) or in the manufacturer's instructions or safety precautions label.
- Maintain detailed records of all fumigation-related activity in the deck logbook.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CASE

8. Case studies - grains

8.1. Ship's sweat

A vessel loaded a cargo of white maize in Mexico due for discharge at several ports in Southern Africa. During loading the temperatures experienced were in the 30°C range. When loading was completed the cargo was fumigated.

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 were not opened until 12 hours prior to arrival at the discharge port.

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 fumigators and charterers. 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, and the subsequent impact on the cargo.

8.2. Corroded pipe caused wet damage to grain

A handysize bulk carrier had loaded grain in all its four cargo holds in a European port for discharge in an African port. Prior to loading, the crew cleaned the cargo holds by washing with seawater and rinsing with freshwater. A pre-load inspection took place at the load port, during which the shipper's surveyor found the bilges to be dry and the cargo holds suitable to receive the cargo.

The vessel arrived at the discharge port and when 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. After several days' delay, it was agreed that the damaged cargo could in fact be properly segregated, and discharge operations resumed.

However, the separation process became confused resulting in wet and dry cargo being discharged together.

The discoloured/wetted 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 to a substantial amount of the cargo from hold 1, a far greater amount than the quantity of cargo that had been segregated by the crew.

It was found that the source of the water ingress had been a partially corroded pipe, which had not been picked up during the inspection at the loading port.

What can we learn?

- In this case, efforts by the Club and the appointed P&I surveyor to properly investigate the extent of the wetted cargo were hindered by the fact that attendance was not requested by the member until after the allegations of wetted cargo were initially brought by the receiver. At this point the crew had already finished their initial segregation of the wetted 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 so that the Club and its local representatives can properly investigate the facts and take all necessary steps to gather evidence and protect the member's position.
- Neither the cargo receiver nor the stevedores took appropriate steps to segregate this alleged damaged cargo during discharge. These actions turned what should have been a nominal cargo damage claim into something far more costly.
- The best preventive measures the crew can take in a situation like this are 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.

8.3. Infestation, delay and rain caused damage to grain

A supramax bulk carrier with five cargo holds had loaded grain for human consumption in a European port for discharge at a Middle Eastern port.

The cargo was loaded onto the vessel from both a barge alongside, and also directly from the quay, transported by lorries which unloaded the grain 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 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 should then have been dried prior to loading resuming.

The Master was concerned by the frequent rain interruptions and the methods used to load the cargo from the quay. He stated he had seen cargo being dumped on the wet steel plate, but he did not issue a letter of protest and he did not clause the mate's receipts or bills of lading.

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

This incident took place in December and so darkness fell at around 16.00. It was difficult for the crew to observe the condition of the cargo properly during loading, or see if the cargo in the hold was wet or not. There were no extra lights rigged for the cargo holds.

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.

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.

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 been unloaded already 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?

- Most likely the cargo damage was caused by wet cargo being loaded on board and 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 onto 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, we must ask the question - 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, however, 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.
- There must be sufficient lighting at night to enable visual inspection of the cargo during loading. It is also essential that the crew monitors weather reports and radar so that the cargo hatch covers can be closed before any rain begins. The log book did not record 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.

Image (v) - Loading in poor weather

Image (vi) - Loading in poor weather

Image (vii) - Damaged cargo at the discharge port

8.4. Incorrectly applied pellets caused explosion

A bulk carrier loaded bulk grain in the US Gulf. The cargo was fumigated on completion of loading. The fumigator applied 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. One of the holds exploded shortly after departure and the hatch cover was partially displaced. The crew ventilated the other holds as a precaution.

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.This was in direct contradiction to the application menthod recommended in the fumigation manual which advises that piles of fumigant should be avoided.

In addition to the structural damage to the vessel cargo damage occurred due to poor weather conditions after the explosion, despite attempts to cover the gaps in the hatch cover.

What can we learn?

- Check the fumigation application method and that it corresponds to the information provided in the fumigation documents or certificate.
- Check the type of fumigant, the formulation (pellets, tablets …) and brand of the fumigant, and what type of recirculation fan (if used).
- Know the quantity of fumigant being used in each hold.
- Ensure correct distribution of the fumigant on the cargo.
- In this case the fumigation pellets were applied incorrectly. A diligent Master needs to carefully follow the fumigator's instructions 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.

9. Case studies - soya beans

9.1. Poor condition when loading

A 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 due to damaged cargo.

Black coloured beans had been observed during discharge, but it was found that these had been in a discoloured state prior to loading. It was further determined that no further discolouration had been generated on board during the voyage.

Unfortunately the discoloured cargo had been mixed with a sound cargo during loading. 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.

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 of soya bean cargoes.

It is nearly impossible to prevent self-heating damage when a cargo has a high moisture content which cannot easily be detected by 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, as they may be needed in a 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.

9.2. 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 was forced to stay at anchor for four months as the charterers had not been paid for the cargo.

The crew then discovered smoke and heat coming from inside the holds. Two days later the vessel berthed.

At this point it was ascertained that a great deal of the cargo was damaged and the local authorities declared the entire cargo to be a total loss and ordered the cargo to be destroyed.

It appears that self-heating damage occurred solely due to the inherent nature of the cargo. It was established that there was no water ingress of any kind and 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 during the investigation by a fire expert.

The Club settled 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).

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.
- 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 any pattern of damage in the cargo hold(s) and to take samples for analysis for evidential purposes, should they be needed as a 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 cargo holds which contain the same type of cargo (i.e. soya beans), and which were loaded in sound condition, but result 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 by 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.

9.3. Discolouration

A 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.

Accordingly, the Master claused the mate's receipt but the shipper registered a protest. The charterers and sub-charterers were also called upon to resolve the matter. Eventually, the mate's receipts were issued clean in exchange for letters of indemnity issued by the charterers and sub-charterers.

At the discharge port, no claims were made in relation to the purple-spotted cargo, as the receiver had 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 the Club for assistance whenever there are doubts about the condition of the cargo that is being loaded.

9.4. Ship's sweat - cargo self-heating

This case study demonstrates the complex relationship between various pre-shipment, voyage, discharge and mitigating factors, including ventilation.

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

The vessel arrived at Qingdao anchorage in March, but was delayed at anchorage for over one month. No ventilation had been carried out during the voyage to China but ventilation commenced in late March according to the three degree rule. During the delay at anchorage, the surface of the cargo in all five holds began to deteriorate and mould growth became visible. The vessel was only equipped with natural ventilation, and therefore 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 when ventilation was required but not carried out (depending on the hold). For most of the voyage, therefore, the correct ventilation decision was made.

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.

10. Conclusion

The guidance in this publication has been based upon the practical experience of the Club's Loss Prevention Team, its members and their crews.

Whilst many of the claims that we have explored in this publication could not have been physically prevented by our members, the most effective defence against cargo claims is the maintenance of clear and accurate records and documentation of each stage of the voyage, from loading through to discharge constant record keeping including photographs.

We are here to help you - our network of regional offices and correspondents can provide you with the advice and support that you need when you begin to experience concerns over the loading and unloading of cargo.

This publication has focused upon the work that we have been carrying out with our members since 2018. We would also like to thank cargo specialists CWA for their valuable input.

Our aim is to highlight risks that can lead to a claim for our members. By addressing these issues and implementing the preventive measures we believe members can reduce the amount and cost of claims.

We hope you found this publication interesting and informative.

For further information please contact **lossprevention@swedishclub.com**


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Head Office Gothenburg
Visiting address:
Gullbergs Strandgata 6, 411 04 Gothenburg

Postal address:
P.O. Box 171, 401 22 Gothenburg, Sweden
Tel: +46 31 638 400 | E-mail: swedish.club@swedishclub.com

Emergency: +46 31 151 328

For more information about Bulker focus: Carriage of grains and soya beans, please contact

Johan Kahlmeter
Director, Claims

Telephone: +46 31 638 411
E-mail: johan.kahlmeter@swedishclub.com

Author

Joakim Enström
Senior Loss Prevention Officer

Telephone: +46 31 638 445
E-mail: joakim.enstrom@swedishclub.com

Lorraine M. Hager
Loss Prevention & Marketing Advisor

Telephone: +46 31 638 492
E-mail: lorraine.hager@swedishclub.com

Peter Stålberg
Senior Technical Advisor

Telephone: +46 31 638 458
E-mail: peter.stalberg@swedishclub.com

Ellinor Borén
Claims & Loss Prevention Controller

Telephone: +46 31 638 449
E-mail: ellinor.boren@swedishclub.com

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