The Swedish Club

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CARGO ADVICE

Soya bean cargoes

Introduction

The loading, carriage and discharge of bulk soya bean cargoes can present numerous challenges. This advice highlights the main areas to consider when carrying bulk soya bean cargoes.

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 the USA who account for approximately 80% of the global export market.

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.

Guidelines for the shipment of soya bean cargoes

1. Pre-loading

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

For most dry agricultural cargoes, including 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 requirements are not clearly defined.

For example, vessels loading grain 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 cooperators 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 definitions and stringency to which the 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. 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.

- **Appoint a surveyor:** It is recommended that a local surveyor is appointed prior to loading. The surveyor should pay particular attention to the bilges, ensuring they are clean and dry as these are a frequent source of wet damage claims.
- **Hatch cover testing:** It is prudent for a hatch cover test to be undertaken prior to loading. This can be done 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 loading of cargo. Furthermore, they provides good supporting evidence against accusations of water ingress through the hatch covers in the event of a wet damage cargo claim.
- **Check cargo suitability:** 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. If the Master is unfamiliar with loading soya beans then accepted industry guidelines available on board, such as Thomas' Stowage, should be referred to so the Master is informed on the safe carriage of the cargo. For soya beans the most helpful information to obtain at loading are details of the cargo moisture content and temperature.

2. During loading

An appointed surveyor should pay close attention to the condition of the cargo during loading. Specifically, they should record the cargo temperature at regular intervals using a calibrated temperature probe. They should keep a record of colour and odour of the soya beans throughout loading.

Clear photographs of the cargo and loading operations are also invaluable. These 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 visually poor condition. In the event a cargo quality issue is suspected, it is also recommended that the cargo is representatively sampled according to sampling methods of Federation of Oil, Seeds and Fats Associations (FOSFA) for oilseeds. Analysis of representative samples from the load port may become crucial evidence in the event of a claim.

The Master and Chief Engineer should consider the location of heated Fuel Oil tanks (FOTs) prior to loading and, if possible, stow cargo away from heated FOTs. 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.

Fumigation

Soya bean cargoes, along with other grain and oilseed cargoes, are usually fumigated on completion of loading. The fumigation is typically performed in-transit although sometimes the cargo may be fumigated ashore prior to loading or on arrival at the destination. Masters should familiarise themselves with the IMSBC Code Supplement MSC.1/Circ.1264 (27 May 2008) as amended by MSC.1/Circ.1396 *Recommendations on the Safe Use of Pesticides in Ships Applicable to the Fumigation of Cargo Holds*.

The fumigator should provide the Master with documentation describing the type of fumigant, the method of application, the dosage and duration of exposure. The quantity of fumigant should be calculated based on the total volume of the hold and not the quantity of the cargo. In addition to this information, appropriate safety equipment and instructions should be provided to the Master relating to crew safety during fumigation. This should include the ventilation requirements to ensure the holds are gas free.

The most common fumigant used for soya bean cargoes is aluminium phosphide. The aluminium phosphide reacts with moisture to produce phosphine gas. The fumigant is applied in tablet or pellet form. It may be applied packaged to allow easy removal of the fumigant residue before discharge. The crew should document the fumigant application from a safe distance and ensure that the fumigators are applying the fumigant to the method stated on the fumigation documentation.

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. In some instances, the Master may be advised not to ventilate the hold for significantly longer and occasionally for the entire voyage (particularly when cargo is loaded and fumigated in the USA). If this is the case, owners are recommended to contact their charterer immediately, as a long fumigation exposure period does not take into account changes in environmental conditions that might result in condensation issues relating to a lack of ventilation.

Following the completion of the exposure period, the holds should be ventilated in accordance with the fumigation instructions to ensure that any remaining fumigant gas is dispersed. It is strongly recommended that a fumigation company is appointed prior to discharge in order to check the fumigant gas levels and issue a Gas Free

Certificate. No personnel should ever enter a cargo hold which has not been confirmed as gas free and safe to enter after fumigation.

3. During voyage

Ship's sweat and cargo sweat are types of condensation that form within the hold due to changes in environmental conditions. Condensation can result in a localised increase in the cargo moisture content. This places the affected cargo at increased risk of deterioration and mould growth and an associated rise in temperature. Further discussion on the effects of ship's sweat and cargo sweat on the cargo can be found in the section *Risks associated with carriage* below.

When ventilating bulk hygroscopic cargoes such as soya beans, it is recommended that the 'three degree rule' is used. The rule prescribes that ventilation should occur when the outside ambient temperature is more than 3 °C below the temperature of the cargo at loading and the weather conditions are suitable. It can be assumed that the temperature of the cargo will not change considerably after loading due to the high heat capacity of soya bean cargoes, and therefore no additional temperature measurements need to be taken during the voyage. If the vessel experiences a significant delay prior to discharge, it may be suitable to reassess the cargo temperatures at this stage.

4. During discharge

In most circumstances, discharge of bulk soya beans proceeds without incident. 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.

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

5. Risks associated with carriage

Condensation - ship's sweat and cargo sweat

Ship's sweat forms when the steelwork of the vessel is cooler than the dew point of the air within the headspace. Typically, this occurs when a vessel sails to a cooler climate and the lower external ambient temperature cools the steelwork. As a result, the water vapour within the hold headspace condenses onto the steelwork and then drips on the cargo surface/runs down the frames of the hold. Damage from ship's sweat is typically characterised by wetting and associated mould damage in regular repeating pattern across the surface of the cargo reflecting the frames of the hatch covers directly above. Repeated wetting due to prolonged formation of ship's sweat can result in damage extending deeper into the stow.

Cargo sweat forms when the cargo temperature is lower than the dew point of the air in the headspace. Normally this occurs in situations where colder cargo is loaded, and warmer air is subsequently introduced into the headspace by incorrect ventilation during a voyage or when a cold cargo is discharged in a significantly warmer destination. In this case, the condensation forms directly on the surface of the cargo itself. Damage via cargo sweat is typically characterised by mould growth at the surface of the stow.

Cargo sweat can also occasionally occur when there is prolonged ventilation of the holds with air that is far cooler than the cargo temperature. The introduction of much cooler air from ventilation can reduce the cargo temperature of the immediate surface layer. If there is a significant delay in discharge, moisture from the bulk of the stow may rise and condense against the cooled cargo at the surface via a process known as moisture migration.

Water ingress

Water ingress can take several forms and can result in significant cargo claims. The most common sources of water ingress are ingress through poorly maintained hatch covers, open hatch covers during adverse weather and bilge issues.

- **Poorly maintained hatch covers:** Water ingress through hatch covers commonly presents in the form of obvious columns of mould damage and caked pillars of cargo where the water has leaked directly downwards from the point of entry. The only way to prevent this is to ensure that all hatch covers and manholes are properly maintained and checked regularly to ensure water tightness. The condition of the steel compression bars, rubber hatch cover seals and non-return valves should be regularly checked and maintained accordingly. Ideally, the crew/independent surveyor should ensure that a hose or ultrasound test is performed prior to the voyage.
- **Open hatch covers and ventilation windows:** Ingress through the hatch covers may also occur if they are left open when it is raining, or there is spray on deck during the voyage. If 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 disport due to visible mould growth. To prevent these issues, the Master and crew should pay close attention to the weather and be ready to close hatch covers if required.

Severe weather conditions during the voyage resulting in water on deck and over the holds can also result in ingress through open ventilation windows for example. In the event that such adverse weather conditions are experienced, a sea protest detailing the weather event with photographs may also assist in the defence of a claim.

- **Bilge issues**: Bilge related water ingress typically presents in cargo surrounding the bilge box, on the tank top. Mould and wet damage are usually found and are often attributed to overflowing and poorly maintained bilges. A surveyor or crew member should closely inspect the condition of the bilges prior to loading cargo to ensure that wastewater can be easily removed.

  Furthermore, the bilge levels should be measured and recorded regularly during the voyage and, if necessary, water pumped out to prevent overflow of the bilges. Once discharge of each hold has been completed, the bilges should be inspected for any signs of water accumulation.

Self-heating

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

The degree to which self-heating will manifest 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.

Soya beans have an additional risk of self-heating due to their oil content. As a result, 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.

Although the self-heating of soya bean cargoes can commonly be attributed to an inherently high moisture content and/or temperature, this is not always the case. There are several other potential sources of heat which can initiate the self-heating process, including – but not limited to - insect infestation, cargo lights, improperly fitted fumigant recirculation fans inside the hold, and heated FOTs or FO heating elements adjacent to the holds.

These external heat sources generate localised heating which can initiate the self-heating process.

In the event of self-heating, there is little that can be done to stop the continued increase in temperature. Ventilation only serves to remove warm moist air from the headspace and does not affect the temperature of cargo within the body of the stow.

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

6. Mitigation

The common forms of damage described above, amongst others, often give rise to claims from various parties. It is important to understand that there are a range of mitigation strategies that can be employed to help reduce the quantum of damage. Broadly these can be split into activities performed during discharge and those performed after discharge.

- **During discharge:** If a claim is anticipated, or damage is found, it is recommended that representative samples are obtained during discharge. For soya beans, the samples must be obtained in accordance with the latest Federation of Oils, Seeds and Fats Associations (FOFSA) sampling protocol. Once representative samples are obtained, they can be retained and analysed to investigate a number of factors such as grading and biochemical parameters. It is important to stress that a spot sample cannot be considered representative of the cargo. Ideally a FOSFA cargo superintendent would be appointed to undertake representative sampling either on a unilateral or joint basis.

  In addition to representative samples of the cargo it is important that an effective segregation operation is

put in place. If damaged cargo is in a discrete location, as is often the case with water ingress through the hatch covers, it is suitable and effective to have the damaged cargo segregated by hand. For more widespread damage, typically seen with heavy sweat/ condensation related damage on the surface, it may be more appropriate and practical to remove by 'skimming' with a grab or small payloaders. In every instance, care should be taken to ensure that the most effective and practical segregation method is undertaken. The segregated cargo should also be representatively sampled.

- **After discharge:** Once the cargo has been discharged by the vessel there are several steps that are commonly utilised to help mitigate potential cargo claims. For any soya beans which are self-heating and at high temperature at discharge then it is useful to attempt to dissipate this heat. This can be achieved by spreading the affected cargo out in a flatbed warehouse to help reduce the temperature of the beans. Care should be taken to avoid piling the cargo in high heaps.
Another method used to mitigate the effects of self-heating damage is the blending of the affected beans with beans of a better quality. The practise of blending is commonplace at large processing facilities with reserves of suitable soya beans that can be blended. It is anticipated that suitable blending will minimise the effect of self-heating damage on the final products, soya bean meal and soya bean oil.

When attempting to quantify or validate a potential claim that is raised following mitigation by blending it is important to obtain relevant documents and data, such as the blending ratios and quantities, and the quality parameters and results for each lot that is blended with the affected cargo.

Conclusion

There are a range of considerations for the crew prior to and during the carriage of soya beans. An understanding of the common issues experienced during carriage of this cargo and ways to avoid these issues may well assist in preventing cargo damage and claims.

Loss prevention essentials

- Ensure hold cleanliness before loading.
- Perform ultrasound or hose test before loading.
- Measure cargo temperature during loading.
- The cargo should be ventilated in accordance with the three degree rule during voyage.
- Keep record of pattern/location of any damage. Clear photographs of all stages of the cargo operations provide good evidence in case of a claim.