3

BRITANNIA
LOSS PREVENTION INSIGHT

ISSUE NUMBER 3 // DECEMBER 2021

CARRIAGE OF RICE
AN OVERVIEW FOR THE MARITIME SECTOR

ABOUT OUR PARTNER

CWA SINGAPORE 新加坡

CWA FOOD & AGRICULTURAL COMMODITIES DEPARTMENT

The CWA Food & Agricultural Commodities department provides expert advice on a range of food, feed and other dry agricultural commodities, across the entire supply chain from field to consumer and especially relating to the shipment of these commodities as bulk, break-bulk, bagged, bottled, drummed, refrigerated, frozen and containerised cargoes.

The department applies scientific and commercial expertise to quality management in the international trade of food, feed and other agricultural commodities, with particular regard to damage causation, quantum, food safety and loss prevention. The department also assists in loss mitigation by applying its scientific, operational and commercial experience to advice on cargo utilisation, salvage and disposal.

INTRODUCTION

THE CARRIAGE OF BAGGED RICE CARGO IS A POTENTIALLY HAZARDOUS UNDERTAKING, WITH CLAIMS POTENTIALLY RUNNING TO MILLIONS OF DOLLARS WHEN PROBLEMS ARISE – PARTICULARLY IN THE TRADE BETWEEN SOUTH EAST ASIA AND WEST AFRICA. The Club's loss prevention department has worked with CWA Food & Agricultural Commodities Group to identify the problems encountered in this trade and to share with Members best practices that can eradicate or substantially reduce a Member's exposure to costly disputes and claims.

The major issue with cargoes of bagged rice is the formation of mould or caking which can often be attributed to condensation due to inadequate ventilation, water ingress, moisture migration and improper dunnaging. Other issues include shortages due to pilferage and damage to bags which are torn, slack or lost overboard during stevedore operations. Finally, infestation and fumigation problems are also common in this trade.

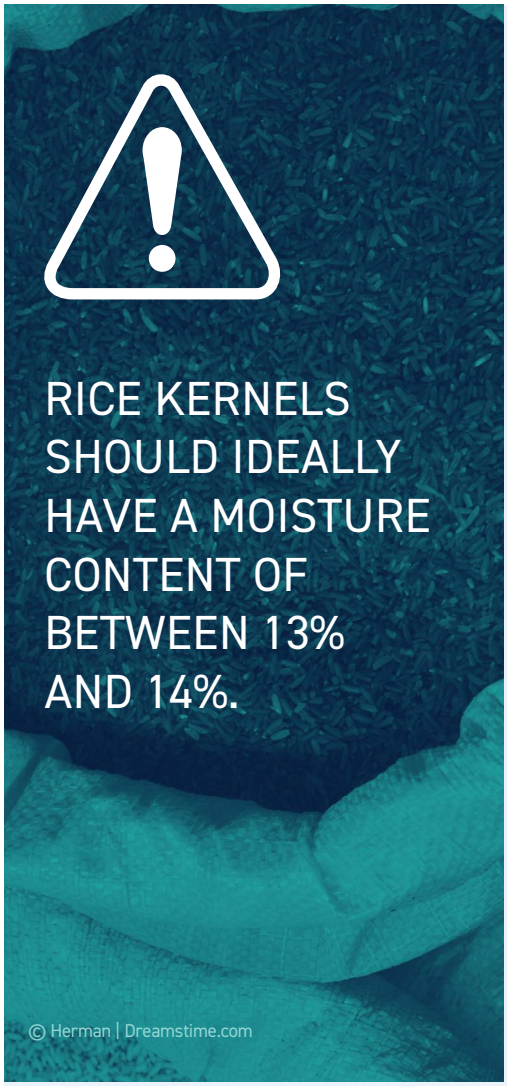
ORIGIN OF RICE CARGO

WORLDWIDE RICE EXPORTS IN 2020 TOTALLED USD24.5 BILLION AND INCREASED BY 18.4% IN A FIVE YEAR TIMESPAN. The major exporting countries are India, Vietnam, Thailand, Pakistan and the US. Rice from Southeast Asian ports has traditionally been shipped in polypropylene bags, although some is now being shipped in containers or in bulk. Rice is shipped in bags or in bulk from US ports and in bulk from the developing rice trade in South American countries.

CARGO QUALITY

AFTER HARVESTING, RICE NEEDS TO BE DRIED TO ENSURE SAFE STORAGE AND CARRIAGE. If rice is not adequately dried, it may be subject to mould growth. Poor storage conditions can result in insect or rodent infestation and the rice can also be contaminated by noxious odours.

Rice kernels should ideally have a moisture content of between 13% and 14%. A moisture content of 14.5% should be regarded as the upper limit and, in case of any doubt, samples should be sent for testing and a note of protest issued if the moisture content is any higher. In addition to moisture content, temperature is a key factor when carrying rice cargo.



The combination of moisture content and temperature influences the equilibrium relative humidity (ERH) between the rice grains. The growth of storage mould is limited at an ERH below 65/70%, above this range the rice may be at risk of mould growth. The ideal carriage temperature for rice is in the range of 5°C to 25°C and if the temperatures and moisture content are higher then there is a greater risk that mould can develop. The temperature of rice loaded in tropical ports is often above this range and, when combined with a high moisture content, bags of rice will be at risk of mould growth and caking during a prolonged voyage. When temperatures reach 25°C and above, increased metabolic processes can also lead to rice kernels caking or sticking together.

Proper cargo care and careful monitoring by ship staff and surveyors during loading, carriage and discharge are essential in order to prevent damage to the cargo and to avoid possible claims. This includes regular measuring of the moisture content and temperature of the rice kernels. Precautionary surveys at the load port are very useful in ensuring that the cargo is loaded and stowed in accordance with industry guidelines. Surveys also provide good evidence of the quality of the cargo at loading. Similarly, tally and discharge surveys are essential to minimise cargo loss and damage claims, particularly due to mishandling or pilfering. The likelihood of pilferage of rice cargo in particular means the tally should be conducted as close to the ship's rail as possible.

Ship staff should monitor the actual and forecasted weather conditions prior to and during loading and discharging in order that cargo operations can be stopped, and the hatch covers closed in good time, in order to minimise cargo damage due to precipitation.

GOOD PRACTICE GUIDELINES DURING THE VARIOUS STAGES OF CARRIAGE

PRELOADING

HOLD CLEANLINESS

FOOD GRADE CARGOES ARE SUSCEPTIBLE TO CONTAMINATION BY PREVIOUS CARGO RESIDUES, PAINT, RUST CHIPS AND ODOURS. Therefore, cargo holds should be properly cleaned and prepared, ideally to grain standards. The accepted definition of 'grain clean' is provided by the National Cargo Bureau in the United States which states that: 'Compartments are to be completely clean, dry, odour-free and gas-free. All loose scale is to be removed.'

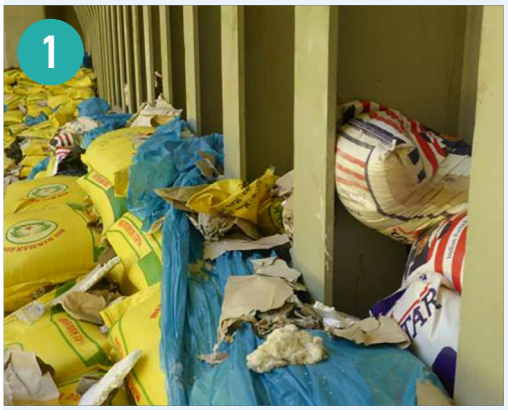


Figure 1: Example of dunnage materials at discharge. Bags shifted during the voyage dislodged dunnage materials between frames.
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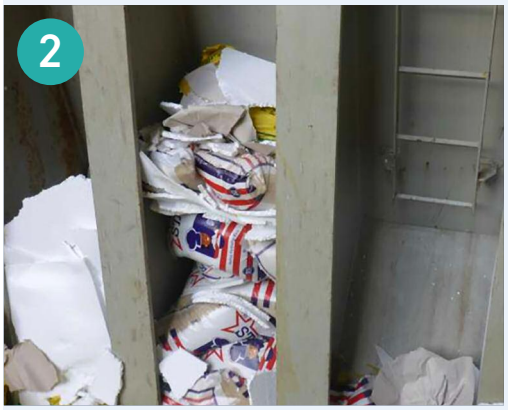

Figure 2: Example of dislodged dunnage and bags found between frames. The dunnage should be placed to avoid bags falling between frames where possible. Bags between frames were mouldy due to condensation and contact with external steelwork.
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The United States Department of Agriculture also inspect holds for suitability to load grains and their Stowage Examination is defined in slightly more detail 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 odor, and otherwise be suitable to store or carry bulk or sacked grain, rice, beans, peas, lentils or processed commodities'*[1].

In general, the holds should be clean, dry and free of residues from previous cargo and with no rust scale. In practice, for bagged rice cargoes, the holds should be dunnaged and the rice packed in polypropylene bags which together should provide protection from any limited dirt present in the holds.

HATCH COVERS

SHIPOWNERS ARE RESPONSIBLE FOR MAINTAINING HATCH COVERS IN A WEATHERTIGHT AND GOOD OPERATIONAL CONDITION. Hatch coamings, hatch packing, ventilators, hydraulics, drain channels, etc. should be checked, and weathertightness verified, ideally by using ultrasonic testing.

DUNNAGE

FOR BAGGED CARGOES, THE TYPE AND APPLICATION OF DUNNAGE SHOULD BE AGREED IN ADVANCE. Properly constructed and applied dunnage is essential to prevent wet damage due to condensation or water ingress, and the dunnage should cover the steelwork as much as possible.

The type of dunnage in general use is known as the Allied Maritime dunnaging arrangement, with a layer of plastic sheeting and kraft paper placed directly against the side shell plating and tank top, with two layers of kraft paper on top of the stow. Styrofoam sheets are placed along the sides of the hold. For holds with side frames, the dunnage should be arranged to avoid stowage of bags between the frames and against the steelwork exposed to seawater. Poor placement of dunnage materials can lead to damage and shortages at the destination (see Figures 1 and 2). The Allied Maritime dunnaging arrangement, although commonplace, has an inherent flaw in that the cargo sits on the tank top and lower hoppers with no physical gap between the bags and the steelwork, only kraft paper and plastic sheeting. Where condensation forms on the shell plating and runs down towards the tank top, the poor applications of the plastic sheeting can lead to the cargo coming into direct contact with moisture and so the use of this dunnaging arrangement is not recommended.

[1] United States Department of Agriculture Grain Inspection, Packers and Stockyards Administration Federal Grain Inspection Service (2009) Directive 9180.48

Figure 3: Example of bag wetted by dripping between the bags at loading.
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Figure 4: Mould growth beneath the packaging.
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The more traditional dunnaging arrangement utilises bamboo poles arranged in a grid on the tank top and lower hoppers, laid to permit water to drain to the bilges. Timber may also be used to form the grid arrangement, which is typically covered with rattan mats or kraft paper. Although this method provides physical separation between the cargo and steelwork and so protects the cargo from potential water damage, it is expensive and takes time to lay the dunnage and so this traditional arrangement is rarely used.

The ship staff should keep a photographic record of the dunnage applied prior to and after completion of loading. The crew should also keep a record of dunnage arrangements on discharge to demonstrate if they were effective.

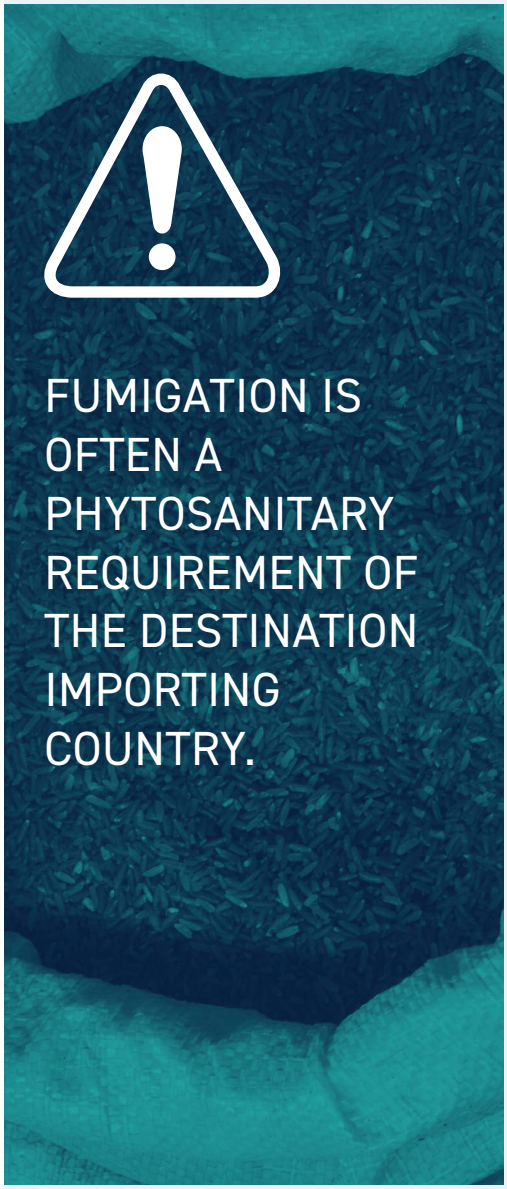
LOADING

THE STOWAGE PLAN SHOULD INCORPORATE ANY SPECIFIC STOWAGE INSTRUCTIONS AND SET OUT REQUIREMENTS FOR CARGO SEPARATION, VENTILATION AND DUNNAGE ARRANGEMENTS, PARTICULARLY FOR BAGGED CARGOES.

Variations in ambient air and sea water temperatures during the voyage can lead to the formation of condensation and, for bagged cargoes, adequate ventilation channels should be provided within the stow during loading if requested. The location and number of these channels will be determined by the carriage instructions.

Ship staff should monitor the temperature of the cargo throughout the loading process. The average temperature of the cargo is important for assessing when to ventilate during the voyage. Ship staff should also monitor the cargo being loaded for signs of damage, mould, insects, wetness or staining etc. Any cargo or bags not in sound condition should be rejected. A Letter of Protest should be issued and ship staff should always take photographs and preserve all relevant evidence to help defend any potential claims.

The crew should closely monitor weather conditions and close the holds promptly if rain or poor weather is expected. They should not rely on shippers, agents or surveyors to make such assessments. Rain wetting of part loaded holds is particularly problematic, as the water drips between the bag layers and affects an unknown quantity of bags (see example of rain wetting at loading in Figures 3 and 4).



Crew/stevedores should wipe down and dry any rain wetted bags immediately as wetted bags quickly become mouldy in tropical climates and can cause issues in adjacent bags. The mould damage is difficult to assess due to the type of packaging. Depending on the quantity, it may be necessary to discharge all the bags stowed in a hold exposed to rain as these would be expected to become mouldy during the voyage and this can then lead to problems at the discharge port.

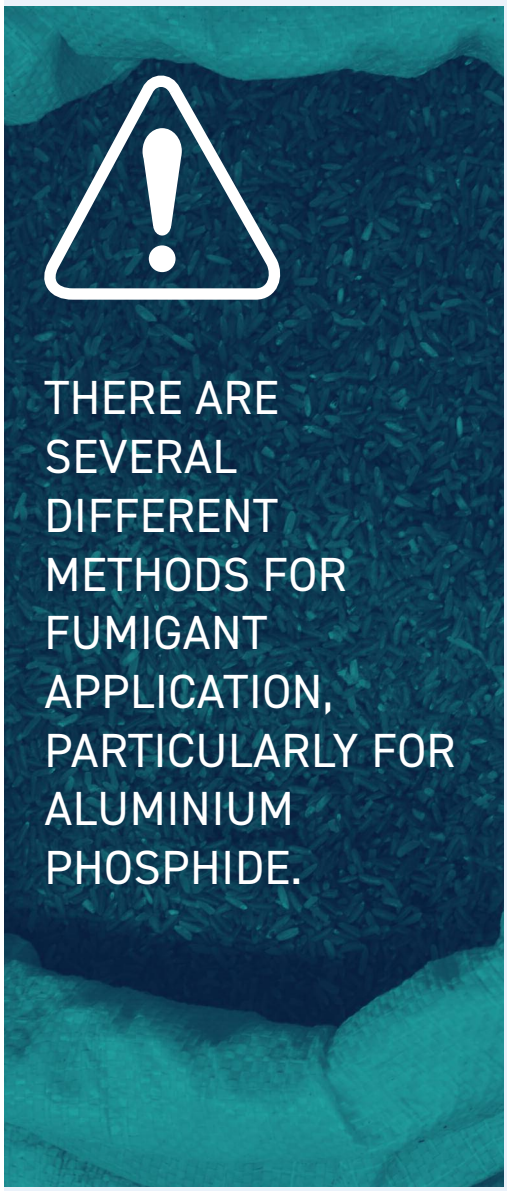
INFESTATION AND FUMIGATION

CARGOES OF BAGGED RICE, BULK GRAINS AND OILSEEDS ARE ROUTINELY FUMIGATED ON COMPLETION OF LOADING.

Fumigation is often a phytosanitary requirement of the destination importing country. It is also necessary as bagged rice cargoes can often be infested prior to loading in warehouse storage or on barges. Good sealing of all hatch covers, vents and accesses is necessary for fumigation to be effective. Where pesticides are used in the cargo spaces of ships prior to, during or following a voyage, the IMO's MSC.1/Circ.1264 – 'Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds', MSC.1/Circ.1358 – 'Recommendations on the safe use of pesticides in ships', and MSC.1/Circ. 1396 – 'Amendment to the recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds (MSC.1/CIrc1264)' must be complied with, as appropriate.

Written instructions should be provided to the master by the designated 'fumigator-in-charge'. The instructions should be in a language readily understood by the master or his representative and must contain details about the type of fumigant used, the possible hazards to human health and the precautions to be taken.

The most widely used fumigant is phosphine (hydrogen phosphide PH3) applied in the form of solid aluminium phosphide. It must be noted that phosphine gas is highly toxic and flammable, colourless, and, when pure, it is odourless. Typically, aluminium phosphide tablets are impure, and the gas may smell of garlic, carbide or decaying fish. The fumigation process requires a relatively long period of time to work completely. A typical in transit phosphine fumigation exposure period is seven to ten days. Methyl bromide is used in situations where a rapid treatment of spaces or commodities is required and fumigation can normally be completed in less than 48 hours. Methyl bromide use now tends to be for strict quarantine purposes rather than routine fumigation as it is an ozone depletor and its use is being phased out. Where fumigation using methyl bromide is carried out, the IMO's guidance should be followed, with fumigation to only take place in port, with the crew disembarked.



There are several different methods for fumigant application, particularly for aluminium phosphide. These include:

• **surface application** – fumigant applied to top surface of the bulk cargo

• **trench application** – a trench is dug and the fumigant placed at the bottom of the trench

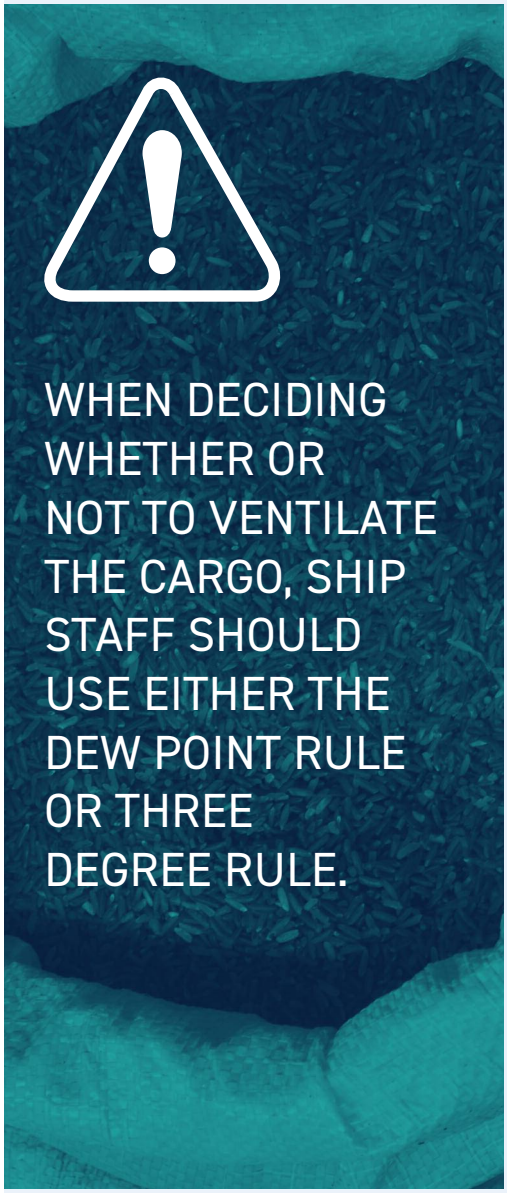
• **probe system** – a probe is inserted into the cargo and fumigant introduced via the probe

• **tubing along the side and bottom of cargo holds** – using a combination of tubing and an explosion proof blower, via which the fumigant is circulated throughout the cargo.

Fumigation of bulk grains of large depths is often ineffective when an inappropriate application method is used because it is difficult to attain a suitably deep penetration of the fumigant gas into the stow during the exposure period. Very deep holds of bulk grain should be fumigated with a subsurface or recirculation fumigation to ensure that the phosphine is distributed throughout the holds at a lethal concentration and for sufficient time.

For bagged rice cargoes, the fumigant tends to be surface applied in sachets or canvas bags. These should be carefully applied to ensure the fumigant does not shift and fall between bags or ventilation channels, since accumulation of aluminium phosphide can lead to fires and explosions, due to the heat generated by the aluminium phosphide tables reacting with moisture to create the phosphine gas.

Following the fumigation process, ventilation of any treated spaces should be completed in accordance with the guidelines provided and a gas-free certificate issued before any personnel are permitted to enter.



DURING THE VOYAGE

MOST AGRICULTURAL PRODUCTS CONTAIN NATURAL MOISTURE AND THE DEGREE TO WHICH THEY MAY ABSORB, RETAIN OR RELEASE THAT MOISTURE WILL DEPEND ON THE SURROUNDING ATMOSPHERE.

The purpose of ventilation is to replace some of the relatively warmer moisture-laden air inside the holds with drier outside air, thereby reducing the potential for condensation. Wherever possible, ventilation should be conducted in accordance with the carriage instructions provided and, obviously, when the weather/sea conditions permit.

As a general rule, cargoes loaded in a cold climate and transported to a warmer climate are not ventilated, whereas cargoes loaded in a warm climate and transported to a colder climate are ventilated. Whilst this is helpful to keep in mind, the crew should still maintain a ventilation log with details of the cargo and environmental conditions during the voyage and details of any periods at anchorage or in port. If rice is being carried as a bulk cargo, surface ventilation will be required, and for bagged/general cargo, surface ventilation as well as ventilation via channels in the cargo will be required.

CONDENSATION

'SHIP'S SWEAT' MAY FORM ON THE SHIP'S STEELWORK (INCLUDING THE SIDES OF THE HOLD, HOPPER TANKS AND TANK TOP) WHEN THE DEWPOINT OF THE AIR IN THE CARGO HOLD IS HIGHER THAN THE TEMPERATURE OF THE STEEL.

'Cargo sweat' may form when the dew point of the air in the hold is higher than the temperature of the cargo i.e. if loading in cold climates and proceeding to warmer climates.

When deciding whether or not to ventilate the cargo, ship staff should use either the Dew Point Rule or Three Degree Rule which are defined as:

DEW POINT RULE

VENTILATE if the dewpoint of the air inside the hold is higher than the dewpoint of the air outside the hold.

DO NOT VENTILATE if the dewpoint of the air inside the hold is lower than the dewpoint of the air outside the hold.

THREE DEGREE RULE

VENTILATE if the dry bulb temperature of the outside air is at least 3°C cooler than the average cargo temperature at the time of loading.

DO NOT VENTILATE if the dry bulb temperature of the outside air is less than 3°C cooler than the average cargo temperature at the time of loading, or warmer.

We would usually recommend that the Three Degree Rule is used. The Three Degree Rule is easier for the crew to follow since it only requires comparison of the average cargo temperature at loading to the ambient temperature. It does not require entry to the hold space to measure dew points as required by the Dew Point Rule.

If bad weather prevents ventilation, the ship staff should record this, take photographs of the prevailing weather conditions, especially if sea water or spray is coming on to the deck, and issue a Sea Protest. Where possible, the cargo should be ventilated according to the Three Degree Rule on a 24-hour basis, including at night. If ventilation is not performed overnight then this should be recorded with the reason why clearly stated. Often when moisture damage is found at the discharge port, a review of the ventilation log reveals that monitoring for ventilation and actual ventilation have only been conducted during the day, and/or that the ventilation rule in use has, on occasion, been improperly applied. In such circumstances, defending claims for condensation damage is problematic.

In addition to a well-maintained ventilation log, the crew should also keep records of bilge soundings during the voyage. The bilges should be checked before loading to ensure they are clean and clear of residue to allow any water to drain freely.

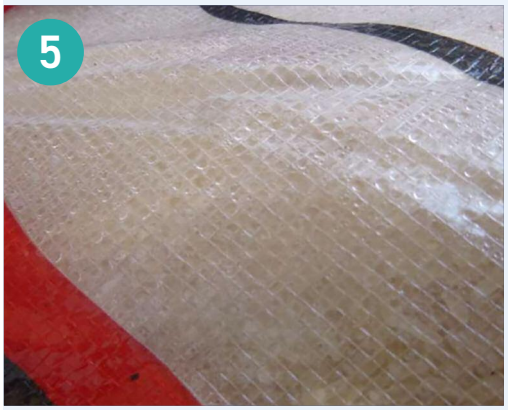


Figure 5: Condensation on interior of bag following exposure to direct sunlight during discharge.
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Figure 6: Example of mould damaged bag stowed against steelwork.
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Figure 7: Example of damaged bag with mould growth and staining consistent with stowage against steelwork.
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DISCHARGE

UPON ARRIVAL AT THE DISCHARGE PORT, PARTICULARLY IF THE PORT IS IN WEST AFRICA, IT IS COMMON TO FACE DELAYS. When a delay occurs, it is vital that the ship staff continue to take temperature readings, ventilate the cargo as required and record all these actions in the deck and ventilation log books. To aid ventilation, if the weather conditions permit, the hatch covers can be opened, subject always to stability considerations and when it is safe and practicable to do so.

The cargo may also require refumigation following a long delay and this will require the consideration of competent and reputable fumigators. Fumigation is the use of a chemical gas. There have been cases where pest control companies in West Africa have issued 'Fumigation Certificates' when in fact they have applied liquid insecticide which has caused issues with cargo contamination, discolouration and mould growth.

It is also advisable for ship staff to keep a close watch on the stevedores during all cargo operations and to take photographs of and report any stevedores that are:

- using hooks which may damage the bags
- mishandling the bagged cargo
- overloading slings
- apparently pilfering the cargo.

In the event of any of the above, the master should issue a Letter of Protest. As well as monitoring the stevedores' activity the crew should also check the daily tally figures provided by attending tally companies and compare to the discharged quantity as calculated by draught survey.

The crew should also monitor cargo condition generally and document by photographs the condition of the cargo surface on arrival and at hold opening.

Bags exposed to direct sunlight can develop condensation inside the bag which may later lead to mould growth ashore. This is unavoidable and not related to carriage by the vessel.

The crew should carefully monitor the weather conditions particularly during the rainy season when sudden heavy rain is common. Any bags that are exposed to rain should be immediately wiped and dried by the crew or stevedores.

Figure 8: Example of bag / water staining of kraft paper on the tank top during discharge.
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Figure 9: Example of an open bag survey to assess extent of damage in a random selection of bags.
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MITIGATION

WET AND MOULDY BAGS

IN THE EVENT OF WET AND MOULDY BAGS AT DISCHARGE, THERE ARE A NUMBER OF KEY POINTS TO CONSIDER TO EFFECTIVELY DEFEND AND MITIGATE CLAIMS. These should be considered to ensure that sufficient information is obtained at the time of discharge to properly assess the cause of damage and advise mitigation efforts.

• Record the pattern of damage in the holds. The location of wet/ mouldy bags in the stow will assist in determining cause of damage.

• Wet/mouldy bags should be segregated during discharge and stored separately from undamaged bags ashore. They should be tallied in the holds and on the quay immediately.

• Check condition and placement of dunnage materials at the sides of the hold and on the tank top. Dunnage residue/ staining of the steelwork may assist with assessing extent of any wetting.

• Check condition of trucks transporting cargo to shore storage. Bags wetted ashore will become mouldy during warehouse storage and may be attributed to the vessel at a later date.

• Check condition of shoreside storage. Bags wetted in storage will become mouldy and may be attributed to the vessel at a later date.

• The quantum of loss can be assessed by surveying a representative number of bags selected from segregated bags. The bags should be laid out and cut open.

• Wet/mouldy bags should be reconditioned by cutting open, removing mouldy rice and repacking sound rice. This is permitted in certain ports and should take place as soon as possible, ideally concurrently with discharge.

SHORTAGE

TO AVOID ALLEGATIONS OF SHORTAGE, MEMBERS SHOULD APPOINT THEIR OWN TALLY COMPANY TO COUNT THE NUMBER OF BAGS DISCHARGED. The crew should check the daily tally figures and check where and how the various tally companies are counting the number of bags discharged. For example, there may be differences in tally figures if tally companies are counting based on different numbers of bags per sling or if they are taking the tally in a different position, i.e., in the hold or on the quay side. The crew should check the daily tally figures and cross reference against a draught survey to check against the total weight of cargo.

CONCLUSION

BY FOLLOWING THE KEY MEASURES OUTLINED IN THIS ARTICLE RELATING TO THE SAFE CARRIAGE AND CARE OF THE BAGGED RICE CARGO, IT SHOULD BE POSSIBLE FOR SHIPOWNERS TO MINIMISE AND DEFEND MOST CLAIMS.

The Club's loss prevention department is always available to support Members and respond to their questions. The master and the ship staff should remain watchful and alert throughout the venture. If a Member experiences any problems pre-loading, during the voyage or at a discharge port then they should contact the Club and the local Club correspondent. The latter will be able to appoint a cargo surveyor to assist with investigating any damage and monitoring discharge.

THE CLUB'S LOSS PREVENTION DEPARTMENT IS ALWAYS AVAILABLE TO SUPPORT MEMBERS AND RESPOND TO THEIR QUESTIONS.

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