
**Industry Expertise:
Loss Prevention**

Carriage of seed cake

The Standard Club's loss prevention (LP) department is a multi-disciplinary team which was established in 1989 and has continually evolved in order to meet the needs of members in an ever changing maritime industry. The team includes master mariners, naval architects, ship production engineers and specialist surveyors.



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Despite the recognised risks, there have been incidents in the past, some significant, resulting from seed cake being shipped without full appreciation of the requirements. This handout addresses the safe and correct carriage of seed cake cargo in bulk. If seed cake is carried in packaged form, please refer to the IMDG code and the [guidance](#) jointly published by the CINS and International Group of P&I Clubs.

Due to its residual oil content and moisture content, this cargo can present a significant fire risk due to self-heating and spontaneous combustion; therefore, the procedures described here should be followed to prevent such casualties.

Members should refer to the latest edition of the International Maritime Solid Bulk Cargoes (IMSBC) code, which should be the first point of reference for guidance on the carriage of solid bulk cargoes. The IMSBC code is amended every two years and its fifth revision (amendment 05-19) entered into force on 1 January 2021.

This amendment introduces a series of changes into the code, including revision of the existing individual schedules for Seed Cake UN 1386 (b) and Seed Cake UN 2217, deletion of Seed Cake (non-hazardous) schedule, and introduction of two new seed cake schedules:

- Seed Cakes and Other Residues of Processed Oily Vegetables (Group B)
- Seed Cakes and Other Residues of Processed Oily Vegetables (Group C)

The guidance provided in this handout supersedes the previously issued Standard Cargo publication on the 'Carriage of Seedcake' issued in October 2011. (With thanks to Dr Chris Foster BSc, PhD, CChem, MRIC, MEI, FIFireE, Dr J H Burgoyne & Partners LLP, David Robbins BSc, CBiol, MSB, MEI, Dr J H Burgoyne & Partners LLP, and Chris Spencer, former Director of Loss Prevention at Standard Club).



Figure 1: Seed cake cargo in bulk

What is seed cake?

Traditionally, seed cake covers only the residual products of oil-bearing seeds manufactured using a solvent extraction process or by mechanically crushing the seeds (known as expelling). However, now the seed cake entry in IMSBC code covers a wider range of products that are made from seeds, grains, cereals, fruit or vegetables, and through chemical processes.

Seed cake cargoes are commonly shipped for use as animal feed or biofuel, and are usually transported in the form of pulp, meals, cake, pellets and expellers. A long list of the products that seed cake can be derived from is listed in the IMSBC code.

With some exceptions, seed cake is a hazardous cargo that can self-heat owing to the residual oil content and/or the presence of moisture. Although the self-heating process is usually slow, it can cause the bulk temperature of the cargo to rise to the point at which it ignites spontaneously. The shipper is required, according to the provisions of the IMSBC code, to provide a certificate from a person recognised by the competent authority of the country of shipment confirming the oil and moisture content of the shipment, on the basis of which the category of the seed cake cargo is determined.

The moisture content of a seed cake cargo is relevant since high moisture content promotes microbiological activity and oil hydrolysis, which may be responsible for the rise in temperature and deterioration in the quality of the seed cake. This activity alone will not cause the seed cake to ignite, but it will accelerate oxidation of the residual oil, which in turn can cause the temperature to rise sufficiently to the point at which the seed cake will spontaneously ignite.

It is therefore important that the cargo is properly aged before shipment. The IMSBC code does not specify what 'properly aged' means. In practice, as the duration of ageing varies with the oil content, 'properly aged' means that the seed cake should be sufficiently mature for oil content that can oxidise at ambient temperatures to have done so.

It is important to measure the cargo temperature before and after loading, as well as during carriage, to ensure that incipient signs of self-heating are detected and the appropriate action can be taken. A digital thermometer of the type shown below is employed for this purpose.



Figure 2: Temperature reading taken during self-heating, which may lead to spontaneous combustion

Types of seed cake

There are five seed cake schedules listed in the IMSBC code 2020 defined by the oil and moisture content and the method of production. These are summarised below:

- Seed Cake, containing vegetable oil, UN 1386 (a): mechanically expelled seeds, containing more than 10% of oil or more than 20% of oil and moisture combined (**IMSBC Group B**)
- Seed Cake, containing vegetable oil, UN 1386 (b): solvent extractions and expelled seeds, containing not more than 10% of oil and when the amount of moisture is higher than 10%, not more than 20% of oil and moisture combined (**IMSBC Group B**)
- Seed Cake, UN 2217: with not more than 1.5% of oil and not more than 11% moisture (**IMSBC Group B**)
- Seed Cakes and Other Residues of Processed Oily Vegetables (**IMSBC Group B**)
- Seed Cakes and Other Residues of Processed Oily Vegetables (**IMSBC Group C**)

The main characteristics of the different grades of seed cake are summarised in the table below.

	UN 1386 (a)	UN 1386 (b)	UN 2217	Seed Cakes and Other Residues of Processed Oily Vegetables	Seed Cakes and Other Residues of Processed Oily Vegetables
Hazard classification	4.2	4.2	4.2	MHB (SH)	N/A
Group	B	B	B	B	C
Size	N/A	N/A	0.1mm to 5mm	Various	Various

Class 4.2 represents cargo liable to spontaneous combustion – hazard classification as per the IMSBC code, section 9.2.2.2.

MHB (SH) means material hazardous only in bulk (self-heating solids) – hazard classification as per the IMSBC code, section 9.2.3.3.

Group refers to the hazard groups of the IMSBC code. Group B consists of cargoes that possess a chemical hazard that could give rise to a dangerous situation on a ship. Group C consists of cargoes that are neither liable to liquefy (Group A) nor to possess chemical hazards (Group B).

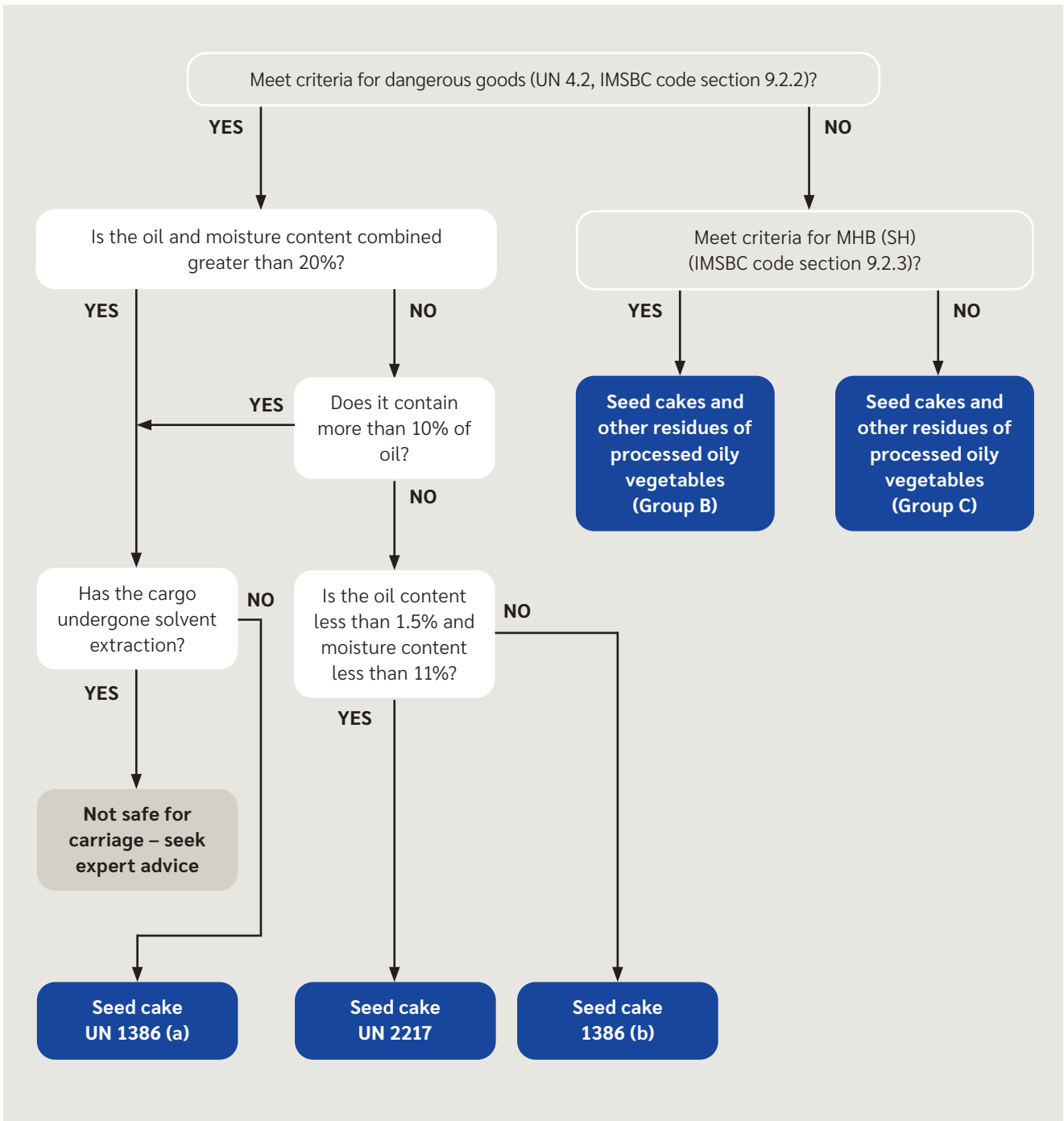
The characteristics of bulk seed cake are:

Angle of repose: Not applicable (*some seed cake cargoes in pelletised form may be non-cohesive – refer to section 5.4 of the IMSBC code)

Bulk density (kg/m³): 478 to 719

Stowage factor (m³/t): 1.39 to 2.09

The flow chart below is a useful tool for determining which category of seed cake a shipment falls under and the respective carriage requirement that applies.



a) Seed cake categories – UN Numbers 1386 and 2217

Seed cakes that have a designated UN number fall into IMDG code Class 4.2 – substances liable to spontaneous combustion – and are categorised as Group B cargoes, which possess a chemical hazard (self-heating as a result of oxidation).

The critical factors used to determine the category of seed cake are:

- The method of oil removal used (mechanically expelled or solvent extracted). Neither of the two ways used to extract or expel oils and fats from the plant material removes all of the oil and it is the reactivity of the residual oil that gives rise to the hazardous properties of seed cakes.
- The oil content and moisture content according to the oil and moisture limits are shown in the graph below.

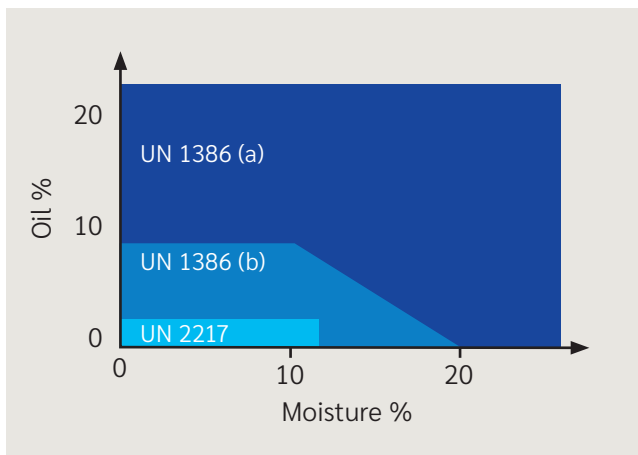


Figure 3: Class 4.2 seed cake oil and moisture ranges

- UN 1386(a) – Mechanically expelled seeds, containing more than 10% of oil or more than 20% of oil and moisture combined.
- UN 1386 (b) – Solvent extracted or mechanically expelled seeds, containing not more than 10% of oil and when the amount of moisture is higher than 10%, not more than 20% of oil and moisture combined.
- UN 2217 – Solvent extracted seeds, containing not more than 1.5% of oil and not more than 11% moisture.

Seed cakes derived from the solvent extraction process (UN 1386 (b) and UN 2217) have an additional hazard arising from any residual flammable solvent mixed in the cargo. Such cargoes should be substantially free from flammable solvents, and a certificate from a person recognised by the competent authority of the country of shipment specifying the oil content and moisture content should be issued.

As for the revised Seed Cake UN 1386 (b) and UN 2217 schedules, the shipper will need to produce a certificate recognised by the competent authority at the country of shipment stating the oil and moisture content of the excluded seed cakes for them to qualify as such. Seed Cakes UN 1386 (a) shall be carried in bulk only with special permission from the competent authority.

Due to the additional risks associated with Group B cargoes, these must be listed on a vessel's document of compliance for the carriage of solid bulk cargoes. Where they are not listed, permission should be obtained from the vessel's flag state – the review of which is subject to installation of suitable firefighting equipment in holds.

b) Seed Cakes and Other Residues of Processed Oily Vegetables (Group B)

This schedule covers seed cakes and other residues remaining after oil has been mechanically expelled or extracted by solvent or other chemical processes from oil-bearing seeds, grains, cereals, fruit or vegetables.

Cargoes covered under this schedule shall:

- be substantially free from flammable solvents or chemicals
- be properly aged before shipment; the duration of ageing required varies with the oil content
- not meet the Class 4.2 (spontaneous combustion) criteria for dangerous goods, as specified in section 9.2.2 of the IMSBC code,
- fulfil the material hazardous only in bulk (MHB) criteria for self-heating (SH) properties, as specified in section 9.2.3.3 of the IMSBC code.

Even though the seed cakes under this schedule do not meet the Class 4.2 criteria for dangerous goods, unless determined otherwise by the competent authority, these should be segregated on board as if they were Class 4.2.

Due to the additional risks associated with Group B cargoes, these must be listed on a vessel's document of compliance for the carriage of solid bulk cargoes. Where they are not listed, permission should be obtained from the vessel's flag state – the review of which is subject to installation of suitable firefighting equipment in holds.

c) Seed Cakes and Other Residues of Processed Oily Vegetables (Group C)

This schedule covers seed cakes and other residues remaining after oil has been mechanically expelled or extracted by solvent or other chemical processes from oil-bearing seeds, grains, cereals, fruit or vegetables.

Cargoes covered under this schedule shall:

- be substantially free from flammable solvents or other chemicals
- be properly aged before shipment; the duration of ageing required varies with the oil content
- not meet any of the criteria on dangerous goods (Class 4.2), as specified in section 9.2.2 of the IMSBC code,
- not meet any of the criteria of materials hazardous only in bulk (MHB), as specified in section 9.2.3 of the IMSBC code.

The way for the above requirements to be met are not specifically mentioned in the schedule, but it is expected that some type of official certification will be required similar to what is required for the revised Seed Cake UN 1386 (b) and UN 2217 schedules in the form of a certificate recognised by a competent authority at the country of shipment.

The club is aware of instances where a Group B seed cake cargo has been misdeclared by shipper as Group C (non-hazardous). Such situations significantly increase the risk of fire, may endanger safety of ship, and cause loss of life and damage to the environment.

Palm kernel shell (PKS)

Palm kernel shell (PKS) is a natural by-product of palm oil processing and is often confused with palm kernel expeller (PKE), which is also a by-product of palm oil processing. PKE contains more residual oil and is therefore regulated in the appropriate section of the IMSBC code as seed cake.

PKS is the woody shell fragments that remain after the oil has been extracted or expelled from palm kernels. This process results in two residual products – PKS and PKE. However, based on the information available, PKS could also be woody shell fragments before the process of oil extraction.

At the time of writing this article, PKS is not listed in the IMSBC code. Yet, it is shipped in increasing volumes these days for biomass energy generation. Due to the physical properties (such as moisture and oil content), PKS cargo may be associated with potential problems such as oxidation, self-heating and the emission of flammable gases. As such, this cargo should not be perceived as non-hazardous.

Following a number of incidents in late 2015 and early 2016, where the cargo was shown to emit very high levels of methane, a submission to have this cargo listed in the IMSBC code was made to the International Maritime Organization (IMO), by Liberia, the Marshall Islands, Poland and the International Group of P&I Clubs, at the IMO's subcommittee of Carriage of Cargoes and Containers (CCC) in September 2016. The proposal is still pending the receipt of more concrete information regarding the cargo's properties and characteristics before it can be finalised.

As PKS is currently not listed in the IMSBC code, its carriage will be governed by section 1.3 (cargoes not listed in the code) of the IMSBC code, ie an approval will need to be sought from the competent authority of the load port, discharge port and ship's flag state before shipment can take place.

When the carriage of PKS is proposed by the charterer, shipowners and operators are recommended to:

- Obtain cargo information (as per section 4.2 of the IMSBC code) from the shipper sufficiently in advance of loading. This should also include a certificate issued by the competent authority of the port of loading, stating the characteristics of the cargo and the required condition for carriage and handling of this shipment.
- Ensure charterparty (C/P) clauses or voyage orders relating to ventilation, fumigation, etc are carefully read and understood by the shipboard team.
- Accept the cargo for loading only if its temperature does not exceed 55°C and the moisture content does not exceed 11%.
- Prohibit smoking and hot-work on deck while the cargo is on board.
- Ensure that the cargo is kept as dry as practicable, that it is not handled during rain or precipitation, and that all non-working hatches of the holds are kept closed.
- Restrict access inside cargo holds and the adjacent spaces to the holds. Any entry (if necessary) should be done in accordance with enclosed space guidelines (after proper ventilation, gas checks and with proper PPE).
- During the voyage, carefully monitor and record temperature, oxygen, carbon monoxide and methane levels inside the cargo holds. The gas monitoring equipment should conform to the requirements stated in the IMO MSC. 1/Circ.1477 and should be calibrated annually to ensure readings are accurate.
- Carry out surface ventilation if methane levels exceed 1% by volume of 20% LEL. Do not ventilate if methane levels are above the LEL and oxygen levels are below 10% by volume. (The catalytic sensors normally used for the detection of methane rely on the presence of sufficient oxygen for accurate measurement. This phenomenon does not affect the measurement of carbon monoxide or the measurement of methane by infrared sensor. Further guidance may be obtained from the instrument manufacturer.)
- In an event of fire, the ship should batten down hatch covers and use fixed firefighting installation. Exclusion of air may be sufficient to control the fire but may risk the accumulation of methane. If methane levels rise, the risk of explosion should take precedence over the risk of fire.

Hazards associated with the carriage of seed cake

a) Self-heating and spontaneous combustion

The presence of oil and moisture in seed cake cargoes can, through a combination of microbiological activity and oxidation/hydrolysis of oil, cause self-heating within the bulk of the stow. Microbiological self-heating, driven by the inherent moisture content, can raise the temperature of the cargo to a point where oxidation of the residual oil occurs. This oxidation can result in further self-heating occurring. Therefore, the higher the moisture content, the higher the risk of microbial activity leading to self-heating, subsequent chemical heating and spontaneous ignition.

In view of above, the cargo temperature should be regularly monitored both during loading and throughout the voyage at a number of depths within the stow. The use of sounding pipes for obtaining readings is the most common method but is likely to be ineffective at providing a representative temperature reading of the bulk of the stow.

In respect of Seed Cake UN 1386 (a) and Seed Cakes and Other Residues of Processed Oily Vegetables (Group B), for cargo schedules that present the highest risk of self-heating, the cargo temperature shall not be greater than 10°C above ambient temperature or 55°C, whichever is the lower, prior to loading.

Should the temperature of any seed cake cargo reach 55°C during the voyage and continue to rise, then ventilation must be stopped. If self-heating continues, then the ship should batten down hatch covers and carry out boundary cooling. Exclusion of air may be sufficient to control self-heating; however, in the event of a fire, consider using fixed firefighting installation.



Figure 4: Wet seed cake with mould, self-heating

b) Cargo damage

As with other dangerous goods, the IMSBC code requires hazardous seed cakes to be kept as cool and dry as reasonably practicable and stowed away from all sources of heat or ignition.

Exposure to external sources of heat can cause localised heating and damage to the cargo in the areas where there is direct contact. Possible external sources of localised heat damage can include the following:

- Cargo loaded in holds over heated fuel tanks or hot fuel oil lines
- Cargo stowed in holds against hot engine room bulkheads
- Hold lighting being left on when the vessel is loaded
- Poor electrical wiring in the holds
- Carelessly discarded smokers' materials



Figure 5: Broken temperature gauge, resulting in seed cake damage

In respect of smokers' materials, it is important to emphasise that live cigarette ends can be transferred from the shoreside and buried in the cargo during loading operations. This is particularly hazardous if it comes in contact with extraneous combustible material in the cargo.

The IMSBC code is quite particular about UN 1386 (b) and UN 2217 cargo, stating that if the bulkhead between the cargo space and the engine room is not insulated to Class A-60 standard, solvent extraction seed shall be stowed 'away from' the bulkhead. This means that a 'false bulkhead' may have to be constructed, if applicable. This may be done, for example, by using flame-retardant bags containing inert materials or by any equivalent arrangement approved by the competent authority.

However, it is not just hazardous cargo that requires such protection. The heating of fuel oil tanks and the warm machinery spaces adjacent to cargo holds are frequent causes of heat damage to solid bulk cargo, particularly grains, oilseeds and seed cakes.

c) Enclosed space entry hazards

i. Oxygen depletion

The oils in seed cake are liable to oxidise, causing a subsequent reduction of the concentration of oxygen in the air inside the cargo space. Additionally, carbon dioxide and carbon monoxide may be produced in the event of severe heating and/or spontaneous combustion.

As with all agricultural cargoes, personnel should therefore not enter any space loaded with seed cake until the atmosphere has been properly ventilated, tested and has been confirmed as safe. Care should be taken to ensure that not only are cargo spaces tested but also that all spaces open to the holds are tested and confirmed as safe for entry. Even when the hatch covers have been open for some time, the ladder access trunkings may still not be properly ventilated.

There have been a number of crew fatalities on bulk carriers in the recent past caused by enclosed space entry procedures not being followed. Members are recommended to refer to the club's 'Master's Guide to Enclosed Space Entry' which is aimed at assisting seafarers entering enclosed spaces safely and preventing enclosed space-related casualties.

ii. Fumigation

Fumigation is common practice for ships engaged in the carriage of agricultural cargoes such as grains and seed cake. It can be carried out in port (before or after the loading of the cargo) or during the voyage.

Adequate precautions and notices should be in place when dealing with fumigants on board as these can be extremely hazardous and have the capability to produce toxic and explosive gases. It is therefore recommended to obtain specific instructions from the charterers and the fumigation company on the required procedure and time for making the holds gas-free, so that they can be rendered safe for crew entry.

SOLAS Reg.VI/Reg. 4 on the use of pesticides in ships, states that appropriate precautions shall be taken in the use of pesticides in ships, in particular for the purposes of fumigation. The IMDG and IMSBC codes provide similar recommendations to ensure safe and effective fumigation.

Further guidance related to the fumigation of cargo is laid down in the IMO circulars MSC.1/Circ.1264 (Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds) and MSC.1/Circ.1358 (Revised recommendations on the safe use of pesticides in ships).

The most commonly used fumigants are aluminium or magnesium phosphides, which usually come in the form of tablets or pellets. Another type of fumigant used is methyl

bromide, which is applied in gaseous form and, hence, is not approved for in-transit fumigation. IMO MSC.1/Circ.1358 mentions specifically that fumigation with methyl bromide is permitted only when the ship is within a port, either at anchor or alongside, and the crew has disembarked. Before personnel are permitted to enter, the treated spaces need to be well ventilated and issued with a gas-free certificate.

Particular attention must be given to the disposal of the fumigant residues. MSC.1/Circ.1264 mentions that 'clear written instructions must be given to the master of the ship, to the receiver of the cargo and to the authorities at the discharging port as to how any powdery residues are to be disposed of'.

The master should be provided with written instructions by the fumigator-in-charge on the type of fumigant used, the hazards to human health, the precautions to be taken and the ventilation process to make the cargo holds gas-free. Such instructions should be written in a language readily understood by the master or his representative. The ship, when carrying fumigated cargo, should be provided with suitable gas-detection equipment to verify the concentration of the fumigant gases.

iii. Ventilation

Seed Cake UN 1386 (a) cargo shall not be mechanically ventilated (except in an emergency) and caution is required when mechanically ventilating other hazardous seed cake cargo, as it may enhance the oxidation process, causing self-heating or spontaneous combustion.

In addition, for the carriage of Seed Cake UN 1386 (b) and Seed Cake UN 2217, all ventilation openings on the deck shall be fitted with spark-arresting screens.

Seed Cakes and Other Residues of Processed Oily Vegetables (Group B), if in dry pelletised form, may present a risk of dust explosion. All sources of ignition shall be considered and avoided to prevent possible dust explosions.

Persons who may be exposed to the dust of the cargo shall wear a dust filter mask, protective eyewear and protective clothing, as necessary.

To provide ship's masters and crew with an understanding of different ventilation requirements for bulk cargoes, Intercargo, the Standard Club and DNV GL, have published a '[Ventilation Guide](#)'. The guide covers the main aspects on how and when to ventilate to reduce the risk of condensation and to remove flammable and toxic gases released from cargoes. In addition, fumigation issues and the entry of ship's personnel into confined spaces are addressed. The guide also sets out the regulatory requirements related to ventilation.

Documentation

In accordance with section 4.2 (provision of information) of the IMSBC code, the shipper/charterer should provide the master or his representative with appropriate information on the cargo sufficiently in advance of loading to enable the precautions that may be necessary for the safe loading and the proper stowage and safe carriage of the cargo to be put into effect.

The information provided by the shipper should be accompanied by a declaration stating the correct bulk cargo shipping name (BCSN) of the cargo together with the cargo group, the IMO class, UN number and other chemical/physical properties of the cargo.

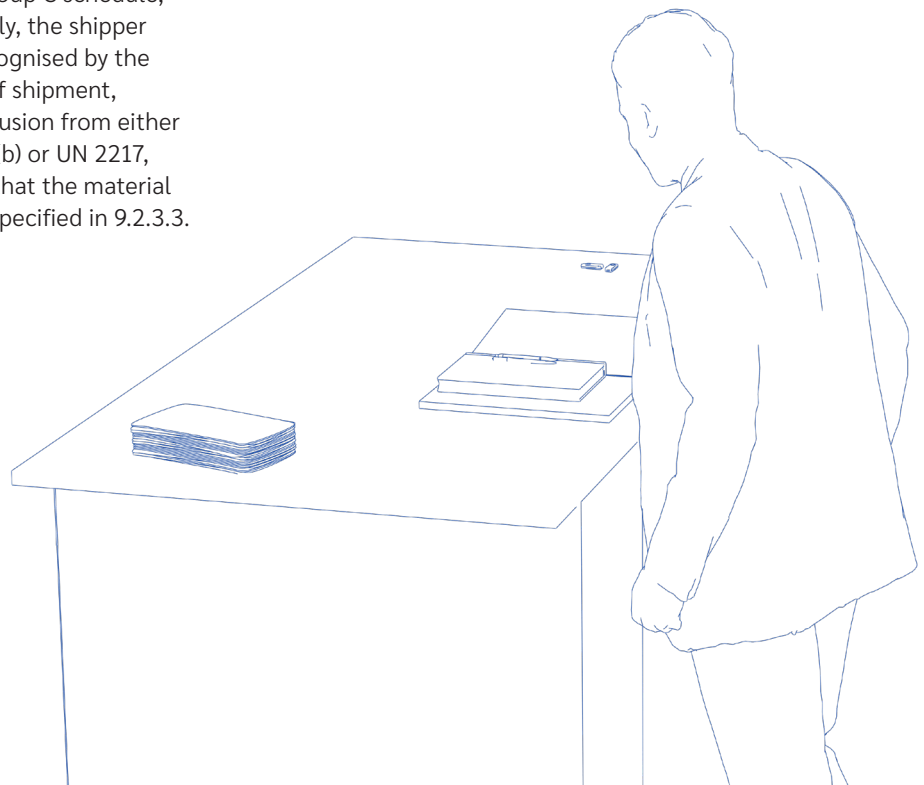
Cargo information shall be confirmed in writing and by appropriate shipping documents prior to loading. When the master is instructed to load a cargo that he is not familiar with, the master should request further information from the owner/operator or charterer.

In the case of seed cakes, a certificate from a person recognised by the competent authority of the country of shipment shall be provided by the shipper prior to loading, stating the oil and moisture content of the material. Based on the oil content of the cargo, the shipper should also declare that the cargo has been properly aged before shipment.

For the cargoes to be classified as Group C, the shipper will need to comply with additional certificate requirements, as mentioned in the Group C schedule, that are applicable to them. Essentially, the shipper will need to produce a certificate, recognised by the competent authority of the country of shipment, stating that the requirements for exclusion from either the schedule for Seed Cake UN 1386 (b) or UN 2217, whichever is applicable, are met and that the material does not meet the MHB (SH) criteria specified in 9.2.3.3.

Documentation required on board a ship carrying dangerous goods

- **Stowage plan**
Each ship carrying dangerous goods in solid form in bulk shall have a special list or manifest setting forth the dangerous goods on board and the location thereof, in accordance with SOLAS regulation VII/7-2.2. A detailed stowage plan, which identifies by class and sets out the location of all dangerous goods on board, may be used in place of such a special list or manifest.
- **Emergency response**
When dangerous goods in solid form in bulk are carried, appropriate instructions on emergency response to incidents involving the cargo shall be on board.
- **Document of compliance for ships carrying dangerous goods**
Cargo ships of 500 gt and over, constructed on or after 1 September 1984, and cargo ships of less than 500 gt, constructed on or after 1 February 1992, subject to SOLAS regulation II-2/19.4 (or II-2/54.3), shall have a document of compliance when carrying dangerous goods in solid form in bulk, except for Class 6.2 and Class 7 goods.



Hold cleanliness

The IMSBC code requires the holds to be clean and dry for all types of seed cake cargo.

Cargo claims involving seed cake cargo are commonly the result of contamination – often by residues from previous cargo and rust scales.

The images show cement from a previous cargo contaminating a cargo of soya bean meal. The bottom image shows one of a large number of pieces of cement found to be of substantial size.

In order that such claims are avoided, the ship is required to ensure that holds are suitably cleaned, with all traces of previous cargo removed.

In many claims, holds are rejected prior to loading due to the staining of the frames and bulkheads from previous cargo, particularly coal and petcoke.

Numerous claims involve cargo contaminated with dust, rust and scale from the tank top or bulkheads. Often, the amount of scale is considerable.

Hold preparation is an important part of the carriage and should not be underestimated. The master should seek proper guidance if he is unclear about the hold cleanliness requirements.

Cargo spaces are usually rejected due to remnants of previous cargo in the upper parts of the hold, underside of hatch covers and on framing (where applicable).

For further guidance, refer to the Standard Club's 'Guide to Hold Cleaning and Preparation'.

Contamination from previous cargo (cement)



Figure 6: Surveyor scraping cement from the bulkhead in the hold



Figure 7: Cement residues in less accessible parts of the hold



Figure 8: Large pieces of cement contaminating the cargo

Loading, stowage and segregation

a) Weather precautions

The IMSBC code makes it clear that seed cake cargo shall be kept as dry as practicable, as the high moisture content of the cargo can cause self-heating through microbiological activity, producing temperatures in the region of 50°C. After this point, temperatures may increase further as microbiological heating switches to chemical heating. Such elevated temperatures can accelerate the heat, producing oxidation of oil in the seed cake and causing the temperature of the cargo to rise further, possibly leading to spontaneous combustion. Steam is usually produced before the cargo takes fire.

The cargo shall not be handled during precipitation. During loading and discharge, all non-working hatches of the cargo holds into which the cargo is loaded or to be loaded shall be closed. Masters and cargo officers should be aware of the prevailing weather conditions and have obtained a weather forecast. Before loading commences, clear communication should be put in place with those in charge of the shoreside operations over the action to be taken in the event of rain.

b) Trimming

Trimming a cargo reduces the likelihood of the cargo shifting and minimises the surface area available for air to enter the cargo. An increased air supply can promote spontaneous heating caused by oxidation of the residual oil in the cargo. To minimise these risks, cargo shall be trimmed reasonably level. The cargo should be trimmed in accordance with the relevant provisions of sections 4 and 5 of the IMSBC code.

The master has the right to require that the cargo be trimmed level, where there is any concern regarding stability based upon the information available, taking into account the characteristics of the ship and the intended voyage.

For trimming purposes, solid bulk cargoes can be categorised as cohesive or non-cohesive. The angle of repose is a characteristic of non-cohesive bulk cargoes that is indicative of cargo stability and has been included in the individual schedules for non-cohesive cargoes.

Under the new schedules of Seed Cakes and Other Residues of Processed Oily Vegetables (Group B and C), it is mentioned that some cargoes in pelletised form may be non-cohesive. The angle of repose of such seed cake cargoes shall establish which provisions of the IMSBC code section 5.4 will apply.

Hatch covers

Hatches of the cargo spaces carrying seed cake shall be weathertight to prevent the ingress of water. The majority of solid bulk cargo damage claims involve water in the holds, and seed cake is no exception.

The images below show seed cake with water damage, resulting in mould, caking and discolouration of the cargo. A ship with leaking hatch covers may be subjected to claims of 'unseaworthiness'.



Figure 9: Water-damaged seed cake

Ongoing maintenance and inspection are necessary to ensure weathertight hatch covers. In order to prevent hatch covers from leaking, it is recommended to ensure that:

- rubber packing is in good order
- compression bars are in good order
- channels and drains are clear of cargo and debris
- securing devices are working efficiently
- the steel fabrication of the hatch covers and coaming are maintained and not holed
- welding of hatchways must not be carried out when they are loaded with cargo.

For further guidance, refer to the club's 'Master's Guide to Hatch Cover Maintenance'.



Figure 10: Compression bar and drain channel in good condition

Discharge

As much as possible, prior to arrival at the discharge port, consideration shall be given to:

- the requirements of the receiving country
- the draught survey
- the cargo surveys where applicable
- the discharge method/sequence
- ballasting
- security aspects
- the ship/shore safety checklist
- monitoring of gangway and moorings
- weather conditions during discharge.



Figure 11: Grain being discharged into shore hopper

Clean-up

The level of cleaning undertaken in the holds following discharge of the cargo should be driven by the requirements of the next cargo to be loaded. Where the next cargo is unknown, holds should be cleaned to 'grain clean' standard (refer to the club's 'Standard Cargo Bulk Hold Cleaning' publication).

Emergency procedures

The temperature of seed cake cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. It is recommended that the temperature of the adjacent bunker tanks to the cargo holds is controlled to prevent further self-heating of the cargo. Particular attention should be given to solvent extraction seed cake (UN 1386 (b) and UN 2217 cargoes), which needs to be stowed out of direct contact with a metal engine-room boundary. However, this requirement need not apply if the bulkhead is Class A-60.

If the temperature of the seed cake cargo reaches 55°C and continues to increase, the master should inform the owner/manager and seek expert guidance. Ventilation to the cargo space should be stopped, holds should be sealed and boundary cooling must be carried out. Subject to stability/stress conditions, crew may consider filling adjacent ballast tanks to the cargo holds.

Effective sealing of the hold may be sufficient to arrest the heat-producing oxidation reaction. This is because the oxygen is used up in the reaction faster than it can be replenished and the oxygen concentration in the hold then falls to a level at which the reaction can no longer be sustained. If, subsequently, ventilation of the cargo space is resumed, it is likely that the oxidation reaction will cause self-heating of the cargo also to resume.

In the event that the cargo continues to self-heat after the hold has been sealed, the temperature within the hold should be assessed by any means available and the master will need to consider further firefighting measures, such as introducing carbon dioxide or inert gas to the cargo space.

The use of CO₂ should be limited to controlling the fire, as further amounts may need to be injected from time to time during the sea passage to reduce the oxygen content in the hold. On arrival in port, the cargo may need to be dug out to reach the seat of the fire.

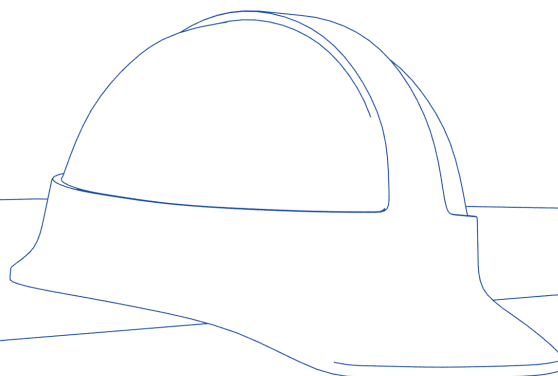
Duties of the cargo officer

The cargo officer, usually the chief officer, should familiarise himself with the properties, characteristics and hazards of the cargo prior to loading. He should understand what measures need to be in place to prevent deterioration of the cargo or a dangerous situation occurring, and what to do should it happen. As per normal cargo operations, he will be responsible for ensuring:

- holds are prepared prior to loading
- cargo gear is in good working order, suitable for the intended work and conforms to Safe Working Load (SWL) requirements
- documents are in order confirming that the shipment is safe for sea transport
- the recording of cargo condition and any pre-shipment damage
- removable hatch covers (where applicable) are stowed in such a place and fashion so as to not be damaged
- the ship's fitness for loading and carrying the cargo (including access, lighting, guard rails, scupper plugs, firefighting equipment, etc., as applicable)
- monitoring the ballast operations
- safe conditions for the working of stevedores on board
- the confirmation of loading/discharging quantities and procedures with shoreside
- the prevention of cargo damage during loading (including the closing of hatch covers during precipitation, where applicable)
- hatches are secure on completion of loading
- the isolation and stowage of cargo gear on completion of cargo operations
- draught surveys/cargo quantity measurements are undertaken
- communications with respect to cargo operations are maintained
- no smoking
- holds' lights are off and electrically isolated
- holds are sealed as appropriate
- photographic evidence of the cargo condition and any damage is always helpful in assessing cause of damage and defending claims. Ideally, photographs should be date stamped and clearly annotated so that the position in the stow/ hold is known.



Figure 12 : Grab loading shoreside hopper



Case study: citrus pulp pellets

The owners of a large bulk carrier were held liable for heat damage to a shipment of citrus pulp pellets when the cargo was found smouldering at the discharge port.

The damaged cargo was located against the warm engine room bulkhead in the after most cargo hold of the 70,000 dwt ship. There were no other heat sources and a survey confirmed that there were no bunker tanks or other heated tanks on the engine room side of the bulkhead.

However, 8 to 12 metres up an engine room escape trunk, heat could be felt radiating from inside the cargo space.

The cargo was a hazardous seed cake cargo, which was liable to self-heating and spontaneous combustion due to its oil and moisture content.

Barges loaded with the damaged cargo were ordered to shift to berths away from the city centre because of the smoke and foul smell.

A significant amount of the cargo was damaged, with losses in the thousands of dollars. Additional costs were incurred due to:

- survey fees
- barge rental
- shifting expenses
- destroying damaged cargo
- customs formalities.

Loss of cargo was limited by segregating sound cargo from the damaged cargo when the ship arrived at the discharge port. Had the ship been delayed, or the voyage been longer, a fire could have started, with grave consequences.

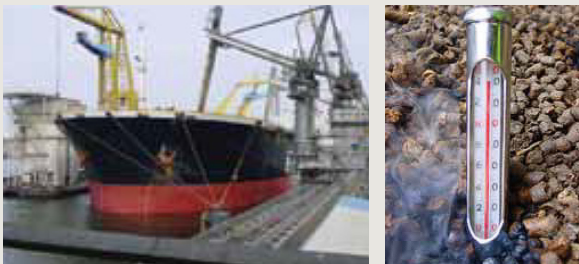


Figure 13 (left): Discharging specialised grain berth
Figure 14 (right): Have a thermometer on board in order to take cargo temperature

Case study: heated soybean meal

A ship carried 55,000 tonnes of soybean meal from Brazil to Thailand. On discharge, it was found that some of the cargo against the engine room bulkhead in the after most hold was discoloured (dark brown), overheated and partly caked.

The location of the fuel oil tanks within the engine room adjacent to the hold bulkhead can be seen from within the hold due to dark heat marks (paint discolouration) at either side of the bulkhead. Additionally, fuel tanks were also located under the tank top of this hold, increasing the amount of heat conducted to the cargo.



Figure 15: Self-heating seed cake



Figure 16: Smoking seed cake cargo. Double bottom fuel oil heating should be managed

The darker parts of the bulkhead were found to be hot when touched. If bulkheads in the holds are found to be hot when touched, and seed cake, grains or other heat-sensitive cargoes are to be loaded, the master should contact the shipowner/operator for advice. In practice, the surface temperature of the bulkhead should be measured by using infrared temperature guns, as the determination of temperature by touch is subjective.

Case study: loading violation – palm kernel expeller (PKE)

Due to the combination of an error on the part of the master, an ambiguous agreement between the owner and charterer, and a misleading certificate provided by the shipper, a bulk consignment of PKE was loaded on a ship in violation of the SOLAS regulations and despite being specifically excluded in the charterparty.

The ship was not:

- designed or fitted for the carriage of this dangerous commodity
- in possession of the required certificates and proper documentation
- observing the necessary safety procedures for the cargo.

The matter came to light only at the discharge port when the port state control inspector requested to see all the relevant documents and records.

Even though PKE was excluded in the charterparty, the owners agreed to load, subject to the shipper supporting his claim that the cargo was ‘non-hazardous’ seed cake as listed in the IMSBC code, by providing a certificate from the competent authority. An independent surveyor was appointed by the owners to supervise the loading operation. The master was informed of these intentions and arrangements. As per the laboratory analysis results provided on board, the consignment conformed

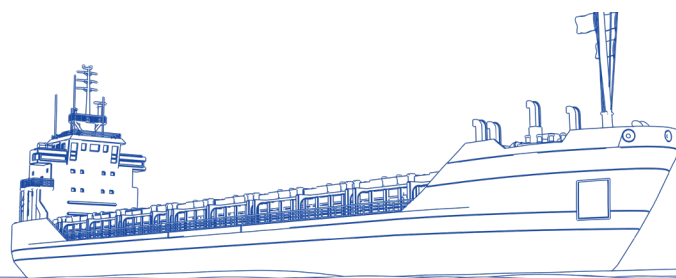
to Seed Cake UN 1386 (b) UN Class 4.2, and the attending owner’s surveyor confirmed this. However, despite clear evidence that the cargo was dangerous, the shipper misdeclared it on his certificate by simply stating that it was ‘non-hazardous’.

The master failed to note the difference between the charterer’s description of the cargo and the type of seed cake determined by laboratory analysis, and the significance of the different types of seed cake as listed in the IMSBC code having regard to carriage conditions. He also failed to appreciate that the ship’s certificate of fitness did not permit the ship to load the cargo being shipped. It was further observed that the crew had not properly documented hold temperature records, having written them on scrap pads and not in the deck logbooks.

It is the master’s responsibility to verify that the ship is properly certified and equipped for carrying any intended cargo as soon as he is told about it by the charterers or owners. He should consult the:

- International Maritime Solid Bulk Cargo Code
- International Maritime Dangerous Goods Code
- Document of Compliance for the carriage of solid bulk cargoes
- Charterparty
- Company’s instructions (operations/cargo/manuals)
- ISM code.

Source: The Nautical Institute Marine Accident Reporting Scheme (MARS)



Club's Cover

Provided that the carriage of seed cake complies with the above-mentioned requirements imposed by the applicable law(s) and international conventions, club cover remains in place. Conversely, the member's failure to comply with the provisions of the applicable regimes and the guidelines may compromise the member's cover pursuant to rule 4.8 of the club rules: '...No claim is recoverable... if it arises out of or is consequent upon the ship ... being employed in an unlawful, prohibited or sanctionable carriage, trade, voyage or operation, or if the provision of insurance for a carriage, trade, voyage or operation is or becomes unlawful, prohibited or sanctionable or if the board determines that the carriage, trade, voyage or operation was imprudent, unsafe, unduly hazardous or improper...'

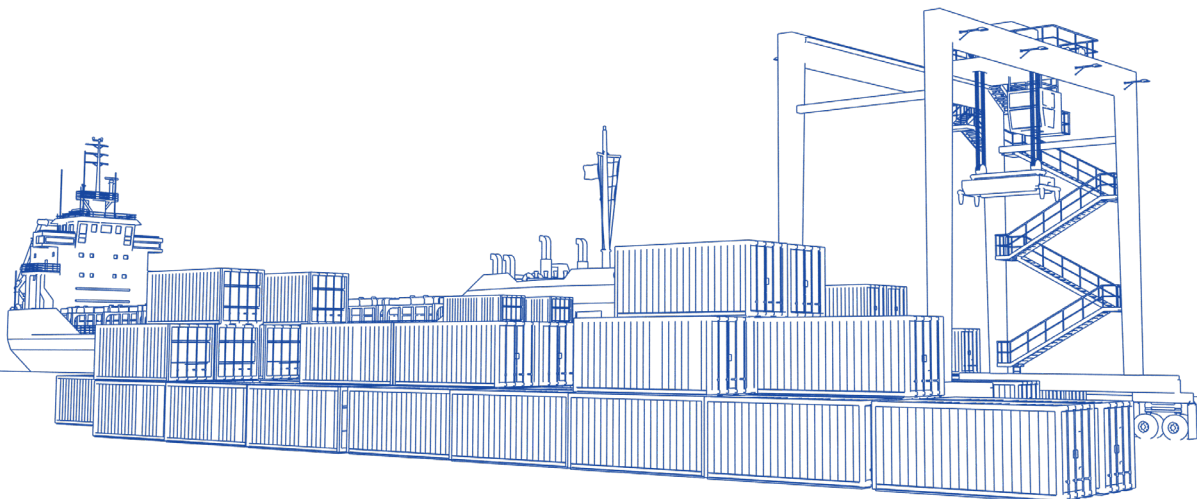
A member's P&I insurance is subject to the warranties, conditions, exceptions, limitations and other terms set out in the rules and the certificate of entry. In case of any further information, members are encouraged to speak with their usual club contact.

The club would like to thank the following contributors for providing their valuable insights in preparation of this article:

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