



# STANDARD CARGO

SETTING THE STANDARD FOR SERVICE AND SECURITY

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## BULK CARGO LIQUEFACTION (IRON ORE FINES AND NICKEL ORE)



^ Discharging wet iron ore fines

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### INTRODUCTION

The Standard Club's loss prevention programme is focused on best practice to help avert claims that are avoidable. In our commitment to safety at sea, and to the prevention of accidents, casualties and pollution, the club issues a variety of safety-related publications.

This edition of *Standard Cargo* focuses on a subject that has been highlighted by a number of bulk carrier ship sinkings: cargo liquefaction. In 2010, the majority of bulk carrier deaths were attributed to cargo liquefaction. This *Standard Cargo* has an emphasis on iron ore fines from India and nickel ore from Indonesia and the Philippines, but the advice in it is also applicable to other cargos susceptible to liquefaction.

The issue of liquefaction affects bulk carriers of all sizes, but liquefaction can affect all ships carrying bulk ores including dry general cargo ships that load parcels of bulk cargo. Cargo liquefaction has been of concern to seafarers for over a century, and it is shocking to find it reappearing to cause loss of seafarers' lives once more.

The carriage of bulk mineral ore has become a focal point after the recent loss in 2010 of three bulk carriers within 40 days, resulting in the deaths of 40 seafarers. The third ship lost, the Hong Wei carrying 40,000 tonnes of nickel ore, sank with the loss of 10 crew. The loss of these ships is believed to have been associated with liquefaction of the cargo, with excessively high moisture content (referred to as MC) in excess of its transportable moisture limit (commonly referred to as TML). All three ships loaded nickel ore in Indonesia. It is known that at least two other ships have had serious incidents, where the ship developed an angle of loll and had to be escorted to the discharge port or beached. There may well be other incidents that have not been reported.

There have also been recent losses of ships (two in 2009) after loading iron ore fines in India, again suffering liquefaction of the cargo. Masters, ship's officers and chartering managers should understand the dangers of liquefaction of certain cargos – usually wet mineral ore fines, but also other cargos such as coal slurry and wet sand.

The International Association of Dry Cargo Shipowners (INTERCARGO) issued a news release calling on shipowners and cargo interests to review their testing and safety procedures in shipping such cargo (a copy of the news release can be found at [www.intercargo.org](http://www.intercargo.org)). The International Group of P&I Clubs have also released circulars to their members warning of the dangers associated with the carriage of iron ore fines and nickel ore, and this can be found on the Standard Club website at [www.standard-club.com/KnowledgeCentre](http://www.standard-club.com/KnowledgeCentre).

In 2009, two bulk carriers, the Asian Forest and the Black Rose sank while carrying iron ore fines during the monsoon season. The Indian Directorate General of Shipping (DGS) investigated the sinking's and concluded that the cause was liquefaction as a consequence of excessive moisture in the cargo. In August 2010 the Indian DGS issued its Merchant Shipping Notice No.9 titled Safe loading, stowage, carriage and discharging of iron ore fines on ships from Indian Ports in fair and foul season (a copy of this notice can be found at [www.dgshipping.com](http://www.dgshipping.com)). However the notice focuses primarily on the duties of the master, when in fact the problem rests as much if not more with the shipper (and the authorities) for not complying with their legal obligation under the International Maritime Solid Bulk Cargoes (IMSBC) Code to supply the correct information, such as the moisture content, transportable moisture limit, and flow moisture point (commonly referred to as FMP).

Masters must clearly understand the whole subject, and should have the support of the company and charterer when making a decision in the interests of safety. Although the Notice issued in India deals with the ramifications of oil pollution and wreck removal as a result of ships capsizing, the issue is primarily one of seafarer safety. **Loss of life resulting from cargo carriage is at stake.**

The Notice however makes some important points:

- shipper to provide the master with appropriate cargo information as stated within the IMSBC Code, in advance of loading iron ore fines
- port authority to ensure shipper provides current cargo information such as moisture content, transportable moisture limit, flow moisture point and cargo density
- masters to verify moisture content before loading (e.g. appointed ship's surveyor taking cargo samples and analysing them)
- master to use his authority under International Convention for the Safety of Life at Sea (SOLAS) to stop loading when necessary
- master to report to the competent authority as well as his owner/ manager and local P&I correspondent if the shipper or port terminal does not provide the proper information and is not co-operating, thereby posing a safety threat to the ship

## THE BACKGROUND

There are basic problems in Indonesia and the Philippines with the carriage of nickel ore. Newly discovered nickel ore mines are being operated by owners who have little or no experience of the mineral's properties or shipment. The locations of the new mines are proving too remote for the attendance of surveyors, and there is a lack of reliable laboratories for testing. As new deposits are found these problems may extend to other geographical areas.

In India, the problems encountered in the carriage of iron ore fines have been attributed to:

- lack of understanding of the issues of liquefaction
- iron ore fines not being declared as a Group A cargo under the IMSBC Code
- no certificates of moisture content and transportable moisture limit issued by the shipper
- cargos being incorrectly described to avoid being subject to the requirements of the IMSBC Code
- inaccurate or fraudulent moisture content or transportable moisture limit certificates issued by the shipper
- only one certificate issued for moisture content and transportable moisture limit even though there may be more than one distinct source of cargo
- masters under commercial pressure not to delay loading and to accept cargos without sufficient certification
- moisture content certificates more than seven days old
- cargo not stockpiled but delivered straight from the mine
- restrictive charterparty clauses
- physical threats and intimidation forcing masters and surveyors to accept cargo
- refusal to provide proper access for surveyors to sample and inspect the cargo before the ship is asked to start loading

The main concerns lie in failures to provide or declare the true moisture content of cargos and determine accurately the transportable moisture limit. Masters and cargo surveyors have been physically threatened and intimidated to load cargos quickly, without being given the time to carry out independent moisture content tests to verify the shipper's declared moisture content.

In India, the flow moisture points for iron ore fines are generally tested in independent laboratories but these may lack the proper equipment or trained personnel to facilitate reliable measurement in accordance with the IMSBC Code. This has resulted in ships loading iron ore fines at Indian ports without accurate flow moisture points, creating dangerous situations where the moisture content of the cargo has been in excess of the transportable moisture limit.

In Indonesia and the Philippines, determination of the flow moisture point for nickel ore has usually been conducted by the owners of the mines themselves. Certain mine owners who lack the proper testing equipment have taken to estimating the flow moisture point, a practice which is contrary to SOLAS and the IMSBC Code. In many cases, after accurate testing of the flow moisture point, the cargo has been found unsuitable for shipment. Mine owners who do possess the testing equipment tend to conduct their analysis of the flow moisture point with their own methodology, not taking account of the laboratory test procedures, or associated apparatus and standards as stipulated in Appendix 2 of the IMSBC Code.

If the cargo is loaded and shipped with moisture content in excess of its transportable moisture limit, the cargo may reach its flow moisture point and develop a fluid state. The cargo may then be subject to liquefaction, resulting in a potential loss of the ship's positive stability from a reduction in metacentric height (GM). The effect on a ship can be sudden and dramatic.



^ Cargo hold with wet iron ore fines. Photo courtesy of Brookes Bell



^ Wet nickel ore cargo

### WHAT IS LIQUEFACTION?

Solid bulk cargoes such as iron ore fines or nickel ore normally contain a degree of moisture within the particles. If the cargo has laid in piles at the mine, having been transported to the terminal in open barges or trucks and loaded onto the terminal stockpiles during heavy rain, there may be a dramatic increase in moisture levels. Masters loading mineral ore fines in rainy seasons should be warned that the certificate issued for the moisture content, transportable moisture limit, and flow moisture point may not represent the real condition of the cargo.

When the cargo is subject to recurring cycles or cyclic forces, such as the movement of the ship (rolling/pitching/slaming), the volume of spaces between the particles reduces, which causes the pore water pressure to rise, reducing the shear strength of the particles. Pore water pressure refers to the pressure of water held within a soil or rock, in gaps between particles (pores). If the pore water pressure increases enough, the cargo can reach its flow moisture point. The cargo enters a stage of transition whereby it begins to react like a fluid because of the loss of friction between the particles. This process is called liquefaction.

The cargo tends to undergo a progressive shift in one direction with the ship's rolling and does not return to the centre. With further rolling, the ship gradually acquires more weight of cargo to one side and develops an increasing list. This dangerous situation leads to further loss of ship stability and potentially capsizing.



^ Water found during loading of nickel ore cargo

### SHIPPER'S RESPONSIBILITIES

The shipper has an absolute responsibility under SOLAS Chapter VI and Section 4 of the IMSBC Code to provide the master or his representative with detailed information about the cargo. The Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code), contained as an annex within the IMSBC Code, also states that terminal representatives must ensure and be satisfied the ship has been 'advised as early as possible of the information contained in the cargo declaration as required by chapter VI of SOLAS 74 as amended'.

Cargo information shall include but not be limited to:

- bulk cargo shipping name (BCSN)
- cargo group (A, B or C)
- group A – cargos which may liquefy
- group B – cargos which possess a chemical hazard
- group C – cargos which are neither liable to liquefy nor possess chemical hazards
- IMO class and UN number
- total quantity of cargo
- stowage factor
- trimming needs and procedure
- moisture content
- transportable moisture limit and flow moisture point
- angle of repose and likelihood of shifting
- formation of wet base
- toxic and flammable gasses which could be generated by the cargo
- toxicity, corrosiveness and propensity to oxygen depletion of the cargo
- emission of flammable gasses in case of contact with water
- radioactive properties if applicable

Information provided by the shipper must be accompanied by a cargo declaration form as stipulated in regulation 4.2.3 of the IMSBC Code. The cargo declaration form should be modelled in the same format as the example given in the IMSBC Code.

**Cargos that have been identified as those 'which may liquefy' must have a signed certificate of moisture content provided by the shipper to the ship's master or his representative, including a signed certificate of the transportable moisture limit as required by Section 4, regulation 4.3.2 of the IMSBC Code.**

If the ship is to load a cargo **which is not listed in the code**, Section 1.3 of the IMSBC Code must be followed. The master must always ensure the bulk cargo shipping name (BCSN) of any cargo to be loaded is ascertained. If the cargo schedule cannot be found within the IMSBC Code, the shipper must consult the competent authority at the port of loading for an assessment of the cargo and acceptability for shipment.

In regard to any cargo not listed in the Code and found to be dangerous and present a hazard to the ship as defined in Groups A or B of the Code ('*may liquefy*' or '*chemically hazardous cargo*'), the competent authority at the port of loading must consult the authorities from the flag state of the ship and the authorities at the port of discharge. Once all these authorities have agreed on preliminary conditions of carriage, the competent authority at the port of loading will issue a certificate to the master stating the characteristics of the cargo including required conditions for carriage and handling of the shipment. This is an impractical process if the ship has arrived at the port to load. Chartering departments must ascertain the correct bulk cargo shipping name before the voyage is fixed.



^ Loading of dry iron ore fines

#### — APPOINTMENT OF AN INDEPENDENT SURVEYOR

In view of the fact that in certain ports in India, Indonesia and the Phillipines the moisture content and transportable moisture limit certificates cannot always be fully trusted, it is recommended that when loading mineral fines or ore, an impartial and an independent cargo surveyor should confirm the suitability and safety of the cargo. It must be stressed that the appointment of a cargo surveyor **does not relieve the shipper of his obligations under the IMSBC Code or any local regulations.**

The surveyor's responsibilities should include but not be limited to:

- assisting the master in complying with the IMSBC Code
- ensuring stockpiles of cargo for loading are identified and are representative of the shipper's samples
- taking an independant sample from the stockpiles for testing in a independent and competent laboratory
- comparison of shipper's and independent samples for moisture content and transportable moisture limit
- assisting with the cargo operations, paying particular attention to rain conditions
- reporting to the master the presence of any wet cargo, particularly cargo from barges
- advising the master during periods of heavy rain and conducting additional moisture content tests when necessary

#### — CHARTERING DEPARTMENTS

Chartering managers have a responsibility to ensure they conclude fixtures that do not put lives of seafarers in jeopardy. Poorly constructed charter party clauses or omissions can put masters under considerable commercial stress. The charterer should comply with the provisions of the IMSBC Code.

Chartering managers should be aware of:

- bulk cargo shipping name (BCSN)
- the IMSBC Code schedule under which a cargo is listed
- cargos that are prone to liquefaction (Group A cargos under IMSBC Code)

- ports and countries that export cargos that may liquefy
- the effects of cargoes that liquefy
- taking independant cargo samples
- the moisture content, transportable moisture limit, flow moisture point and the availability of recognised laboratories for testing cargo samples
- **clauses agreeing to appoint impartial and recognised surveyors to confirm the moisture content, transportable moisture limit, flow moisture point and assistance to the master**
- compliance with the IMSBC Code

Members should not sign any charterparty document which limits the member's rights to apply fully the IMSBC Code or allows the shipper to avoid his duties as defined within the Code.

Express terms should be included in the charterparty or freight contract to safeguard the owner's position. This includes ensuring that proper and accurate moisture content/transportable moisture limit/flow moisture point and cargo descriptions are provided.

#### — MOISTURE CONTENT

The master must satisfy himself that the moisture content of the cargo is not more than the transportable moisture limit. As required by the IMSBC Code, a certificate of moisture content must be provided by the shipper to the master stating the current moisture content with the interval between testing and loading being **not more than seven days**.

Notwithstanding these provisions, questions remain whether the master can trust the information provided by the shipper. For example:

- has the certificate come from a reputable source?
- does the certificate relate to the cargo being loaded?
- have weather conditions changed the characteristics of the cargo since the certificate was issued?

The shipper must identify:

- the laboratory used to conduct the moisture content analysis
- stockpiles from which the cargo has been sampled, which must be stated clearly on any certification issued by the shipper

If there is reason to believe there has been a change or variation in the cargo (such as in the mining process or through stockpiling in heavy rain) efforts should be made to conduct an additional moisture content analysis before loading. This may be particularly pertinent in instances where the cargo has been exposed to rain on uncovered stockpiles or in barges. If there has been significant precipitation between the time of testing and time of loading, **the shipper must conduct further check tests of the moisture content to ensure the cargo is under the transportable moisture limit (4.5.2 The IMSBC Code).**

**Masters and officers should if possible undertake a visual inspection of the cargo before loading, to establish any parts of the consignment which may be appreciably different in moisture content. If this is the case, additional testing should be conducted to determine moisture content. Any parts of cargo found to be in excess of its transportable moisture limit should be rejected as being unfit for shipment.**

In cold conditions, the formation of ice crystals in the cargo is a serious hazard. Voyaging to warmer climates may result in thawing, an increase in moisture content and the possibility of the cargo exceeding its transportable moisture limit, leading to sliding failure or liquefaction. It is important that moisture content analysis of frozen cargo takes place after the free moisture has been completely thawed.

**For cargos that may liquefy like iron ore fines or nickel ore, the moisture content of each type of finely grained material (grades) for each hold should be identified. The shipper will often declare only an average moisture content for the entire consignment,**

which may be accepted under the IMSBC Code providing the sampling meets internationally or nationally accepted standards. The master should exercise caution when accepting a reading of an average moisture content when there is reason to believe that it may not be representative of the entire consignment. Cargo may be taken from different stockpiles which in turn may have been mined at separate locations, at different times and under different conditions. All these factors will inevitably create differences in the moisture content of each consignment and their flow moisture properties.

The master or his appointed representative should never sign any document seeking his confirmation that the cargo is safe to carry. It is quite clear that under the IMSBC Code, the shipper is obliged to declare the cargo is safe for carriage, **not the master**. Signing any document stating the cargo is safe for carriage may prejudice a member's rights against a shipper in the event of a subsequent casualty. **Do not sign such a document.**

If there is any doubt about the validity of the signed certificate of average moisture content, or the cargo is thought to contain excessively high moisture, the master should stop or refuse to load the cargo until it can be ascertained as safe for carriage. An independent and impartial surveyor should take samples of the cargo for testing at a competent laboratory to ascertain the true moisture content.

#### — TRANSPORTABLE MOISTURE LIMIT AND FLOW MOISTURE POINT

Section 4 of the IMSBC Code, regulation 4.3.2, states that the shipper shall provide the ship's master or his representative with a signed certificate of the transportable moisture limit. The certificate of transportable moisture limit must contain or be accompanied by the results of testing and determining the transportable moisture limit. A test to determine the transportable moisture limit of a solid bulk cargo should be **conducted in the six months before the date of loading**.

**The transportable moisture limit is defined as 90% of the flow moisture point.**

In determining the transportable moisture limit of a cargo, the flow moisture point must be determined accurately by an approved laboratory, using the prescribed methods as stated in Appendix 2 of the IMSBC Code 'Laboratory test procedures, associated apparatus and standards'.

**The flow moisture point of any cargo is deemed to be the percentage of moisture content at which the cargo behaves like a fluid and develops a flow state.**

As previously mentioned in relation to moisture content, consignments originating from different stockpiles might have been mined separately and under varying conditions. The flow properties of separate stockpiles may differ greatly and are likely to have a different flow moisture point. If it is found that different grades or stockpiles are to be loaded, **the transportable moisture limit/flow moisture point should be assessed and certified for each consignment separately.**

The shipping company or master should ensure the laboratory used for analysis is one of repute, by checking through local agents, P & I correspondents or appointed surveyors.

The cargo to be loaded should be identified by its bulk cargo shipping name (BCSN) and the appropriate cargo schedule of the IMSBC Code consulted. Cargos 'which may liquefy' are defined and listed as Group A cargos in Appendix 4 of the IMSBC Code. The master must exercise caution in accepting cargos which are not listed as those 'which may liquefy' but may indeed be subject to liquefaction. **Iron ore fines are not listed under a specific cargo schedule, but should be regarded as Group A cargo under regulation 1.3 of the IMSBC Code.**



^ Water draining from iron ore fines. Photo courtesy of Brookes Bell.



^ Stockpiles of iron ore fines surrounded by water. Photo courtesy of Brookes Bell.

#### — FLOW TABLE TEST

The flow table test (FTT) is primarily used to determine the flow moisture point of relatively homogenous mineral cargos. The test requires a cargo sample in the form of a truncated cone to be placed on a flow table, raised and dropped repeatedly, around 50 times, from a measured height. The IMSBC Code provides detailed information on identifying a flow state:

'A flow state is considered to have been reached when the moisture content and compaction of the sample produce a level of saturation such that plastic deformation occurs. At this stage, the moulded sides of the sample may deform, giving a convex or concave profile.' Regulation 1.1.4.2 Appendix 2 IMSBC Code.



^ Flow table test. Photo courtesy of Brookes Bell.

Signs of plastic deformation:

- moulded sides of sample may deform
- cracks may develop on the surface
- sample begins to show tendency to stick to bottom of mould
- tracks of moisture on the table after testing

This test has, however, been criticised as being unreliable, as it subjectively relies heavily on the ability and accuracy of the person conducting the test. One of the biggest disadvantages of using the flow table test is its inadequacy in testing coarser cargos. For inhomogeneous cargos like certain nickel ores, the cargo may have been mixed with other forms of material including very fine clay-like particles or large rock particles, inconsistencies which make it difficult to determine the flow moisture point and transportable moisture limit. There are also types of iron ore fines cargo which simply cannot be tested satisfactorily with the flow table test.



^ Cargo sample on flow table. Photo courtesy of Brookes Bell.

The IMSBC Code refers also to the penetration test, and the Proctor Fagerberg test as testing methods but neither of these are believed to be currently in use in India, Indonesia or the Philippines.

#### THE CAN TEST

An onboard can test may determine the presence of moisture on the cargo surface and possible liquefaction. It is recommended the can test should be conducted purely as a spot check by the master and officers, **but should never replace a full laboratory test as confirmation of safe carriage.**



^ Can test conducted by shore side workers.

#### CAN TEST PROCEDURE

1. Fill half of a small cylindrical can with a sample of the cargo
2. Strike can against a hard surface such as a strong table from a height of approximately 20cm
3. Repeat the action at least 25 times, at one or two second intervals
4. Check surface for moisture and fluid-like behaviour

If moisture is present on the surface or fluid-like behaviour is noticed, additional testing of the moisture content should be conducted by a laboratory **before loading.**

**The can test is not to be taken as an acceptance test confirming that the cargo is safe. It should serve to warn the master or confirm that the cargo is above its flow moisture point and that further laboratory testing is needed.**



^ Separate can tests. Photo courtesy of Brookes Bell.

The advice contained in the Indian M Notice No.9 makes specific reference to the use of a 'can test' but fails to comment on its lack of reliability. A full test in an approved laboratory must be conducted to ensure the moisture content of the cargo is below the transportable moisture limit.



^ Can test showing moisture on surface

Indian M Notice No.9 Paragraph 5(l)(i) states '*ship master shall conduct can test or other test prescribed in the IMSBC Code to the extent reasonable and practicable prior to the acceptance of shipment of cargo along with the terminal representative in case of any doubt about the information submitted by the shipper or quality of cargo.*'

**The club and most experts do not agree with this statement. The can test does not produce conclusive results and should never be solely relied on as a condition of carriage.**

**Masters and officers who rely on the can test as a primary method of testing for accepting a cargo may be putting the crew and ship at risk.** When the can test is conducted, it looks only for the flow moisture point of the cargo and not the transportable moisture limit. The test automatically discards the 10% safety margin if relied on as a condition of carriage. Therefore using the can test as a primary testing method for acceptability of a cargo is contrary to the IMSBC Code.

## TRIMMING

Cargo shifting caused by liquefaction is possible if the moisture content has exceeded the transportable moisture limit. Certain cargos are liable to moisture migration and could develop a wet base. Even though the surface of the cargo may appear dry, liquefaction occurring below the dry cargo may result in a sudden shift of cargo. Cargo, such as iron ore fines, possessing high moisture contents are prone to sliding.

To reduce the likelihood of cargo shifting, the master has the right to require the cargo to be trimmed to a reasonably even level. With reference to Section 5 of the IMSBC Code 'Trimming Procedures', the cargo spaces shall be as full as practicable without forming an excessive load on the bottom structures.

## CASE STUDY 1

During the peak monsoon season, a bulk carrier loaded more than 10,000 mt of iron ore fines in an Indian port and sailed towards a discharge port in the Far East. The weather en route was expected to be hostile with wind speeds over 60 knots and a swell height of 4 metres. The ship developed a starboard list of more than 23° shortly after sailing. The master requested permission from the port authority to return to port but was directed instead to an anchorage six miles off the coast.

While at anchor, the ship took on ballast in its port side tanks, trying to correct the starboard list. This led to the ship developing a large list to port which the crew could not recover from to bring the ship upright.

The master decided to abandon ship and all 18 crew members were rescued. The ship remained at anchor until the next day when it was reported to have sunk.

Although in this case there was no loss of life, there remains a serious cause for concern as the cargo was loaded in a wet condition where the moisture content of the cargo exceeded the transportable moisture limit and reached its flow moisture point.

## CASE STUDY 2

While at anchor off the east coast of India and within port limits, a bulk carrier carrying iron ore fines developed a starboard list of more than 15°. The master tried to beach the ship but failed as the list kept increasing. The ship lost electrical power, developed an angle of loll and eventually capsized. The master and crew abandoned ship.

It is thought the cargo had been loaded in a wet condition with the moisture content of the cargo exceeding its transportable moisture limit and most likely suffered liquefaction.

In this instance, the provisions of the IMSBC Code were not followed. The moisture content and transportable moisture limit of the cargo was not properly tested or certified by the shipper. The master accepted loading of the wet cargo, which had been left in uncovered barges exposed to rain.

**Do not accept cargos for loading that do not have a valid certificate of moisture content and transportable moisture limit. If the shipper fails to produce valid certificates, do not load the cargo.**

## CASE STUDY 3

A bulk carrier was due to load nickel ore in Indonesia. The master was presented with a certificate of moisture content stating it was below the transportable moisture limit. The chief officer went ashore to conduct a can test of the cargo. Cargo samples were taken from four stockpiles. The chief mate and master accepted the results of each can test as no moisture was observed on the surface.



^ Nickel ore stockpile.

The loading process began and some 19,100 tonnes of nickel ore was loaded. The officer of the watch later noticed moisture on the surface of the cargo. The loading operation was suspended and the master requested P&I club assistance.



^ Wet nickel ore.

An independent surveyor arrived and took samples from each of the cargo holds for testing in an independent laboratory. It was found that the moisture content of each sample of cargo was in excess of its transportable moisture limit.



^ Discharging wet nickel ore onto the quayside.

The ship began pumping water from the holds and discharging the wet nickel ore onto the quayside. The discharge process took over nine days to complete.

Masters must be cautious when presented with moisture content and transportable moisture limit certificates. It is clear that in this case, certificates were false and did not represent the true state of the cargo. The master relied on results from the can test as an assurance that the cargo was not in excess of its flow moisture point.

**Do not fully rely on the can test. The can test does not take into account the 10% safety margin of the transportable moisture limit. An independent surveyor should be asked to assist the master in taking samples of the cargo and testing the moisture content and transportable moisture limit.**

## RESPONSIBILITIES

### The shipper

- provide all necessary information relating to the cargo as specified within the IMSBC Code including the proper bulk cargo shipping name (BCSN)
- provide a signed certificate of the average moisture content of each parcel of cargo which shall be **not more than seven days old at the time of loading**
- provide a signed certificate of the transportable moisture limit which **should not be more than six months old from the date of loading**, and with iron ore fines and nickel ore, it is **recommended the transportable moisture limit testing is done at the same time as the moisture content testing**
- the master and his independent surveyor or nominated representative must be allowed unrestricted access to shoreside stockpiles for sampling purposes

### The shipowner

- know the bulk cargo shipping name (BCSN) and properties of the cargo to be loaded
- consider including in the charterparty a clause stipulating the use of an independent and impartial cargo surveyor
- refuse to sign any charterparty agreement which contradicts or restricts any rights as laid set out in the IMSBC Code, consider including an indemnity on behalf of the charterer in respect of the consequences of loading a cargo in breach of the IMSBC Code

### The master

- must ensure the ship has received all the documentation necessary for the safe loading of the ship. **The master should not begin loading until valid certification has been provided**
- **should not load any parcel of cargo which is in excess of its transportable moisture limit**
- if there is any doubt as to the validity of the certificates for moisture content and transportable moisture limit, the master or his appointed representative should carry out tests **before loading**
- an independent surveyor can assist the master in sampling for moisture content analysis (which may be a local requirement)
- in tropical countries **additional moisture content analysis may be necessary**
- the 'can test' method alone **should never be solely relied upon**
- a visual inspection of the cargo will identify the stockpiles before loading to establish parts of the consignment which may have appreciable differences in moisture content
- ensure the cargo is retested for moisture content and transportable moisture limit if it is 'wetter' after rain exposure, or if the certificate is not correct
- ensure the cargo is loaded and trimmed as evenly as possible
- IMSBC Code must always be followed
- resist any commercial pressure
- contact local P & I correspondent if master is in doubt of the suitability and safety of the cargo

**The master has an overriding authority under SOLAS not to load any cargo and to stop cargo loading if any concerns arise that the ship may be affected by the condition of the cargo.**

## ACKNOWLEDGEMENT

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