

# Liquefaction of solid bulk cargoes

A selection of articles previously  
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# Liquefaction of unprocessed mineral ores - Iron ore fines and nickel ore

By Dr Martin Jonas, Brookes Bell, Liverpool.

Dr Martin Jonas considers some of the technical issues behind the casualties involving the carriage of unprocessed natural ores from India and nickel ore from Indonesia, the Philippines and New Caledonia.

## Introduction

Liquefaction of mineral ores, resulting in cargo shift and loss of stability, has been a major cause of marine casualties for many decades. Recent problems, already leading to several total losses this year, have primarily involved the carriage of unprocessed natural ores such as iron ore fines from India and nickel ore from Indonesia, the Philippines and New Caledonia. The main cause of casualties and near misses is the poor compliance of shippers with the testing and certification requirements that are designed to ensure that cargoes are loaded only if the moisture content is sufficiently low to avoid liquefaction occurring during the voyage.<sup>1</sup>

## Principles of liquefaction

Cargoes that are at risk of liquefaction are those containing at least some fine particles and some moisture, although they need not be visibly wet in appearance. The most widely-known cargoes with this hazard are mineral concentrates, although many other cargoes can also liquefy, such as fluorspar, certain grades of coal, pyrites, millscale, sinter/pellet feed, etc.

Although they often look dry in appearance at the time of loading, these cargoes contain moisture in between the particles. At the time of loading, the cargoes are usually in their solid state, where the particles are in direct contact with each other and, therefore, there is physical strength of resistance to shear strains. During ocean transport, cargoes are exposed to agitation in the form of engine vibrations, ship's motions and wave impact, resulting in compaction of the cargo. This leads to a reduction of the spaces between the particles. If compaction is such that there is more water inside the cargo than there are spaces between the particles, the water pressure inside the cargo can rise sharply and press the particles apart

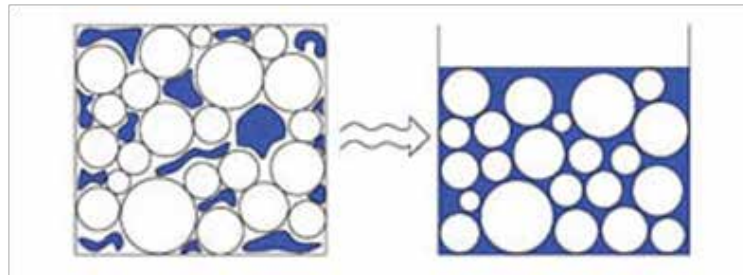


Figure 1: Liquefaction as a result of cargo compaction. In the solid state (left), the shear strength of the cargo is provided by the direct contact between the cargo particles. There are sufficient interstitial spaces to accommodate the inherent moisture and a proportion of interstitial air. As the cargo compacts under the influence of the ship's motions, the volume between the particles reduces and interstitial air is expelled. Eventually, the water pressure resulting from compaction presses the particles apart, potentially leading to them losing direct contact and a resulting sudden loss of shear strength, i.e., a fluid state (right).

(see Figure 1). This suddenly reduces the friction between particles, and thus the shear strength of the cargo.

The effect of this process is a transition from a solid state to a viscous fluid state in which all or part of the cargo can flatten out to form a fluid surface. In this condition, cargo may flow to one side of the ship with a roll one way but not completely return with a roll the other way, progressively leading to a dangerous list and potentially the sudden capsizing of the vessel.

Cargo liquefaction will not occur if the cargo contains a sufficiently low inherent moisture content and sufficiently high interstitial air that, even in its most compacted state, there are still sufficient interstitial spaces to accommodate all of the moisture so that the increase in water pressure is inhibited.

The lowest moisture content at which liquefaction can occur is called the Flow Moisture Point (commonly abbreviated FMP). Its numerical value can vary widely even for cargoes with the same description. It is not possible to predict the FMP of a given cargo from its description, particle size distribution or chemical composition and the FMP therefore needs to be determined by laboratory testing separately for each cargo provided by each shipper.

In cargoes loaded with a moisture content in excess of the FMP, liquefaction may occur unpredictably at any time during the voyage. Some cargoes have liquefied and caused catastrophic cargo shift almost immediately on departure from the load port, some only after several weeks of apparently uneventful sailing. While the risk of liquefaction is greater during heavy weather, in high seas, and while under full power, there are no



Iron ore fines before and after liquefaction.

safe sailing conditions for a cargo with unsafe moisture content. Liquefaction can occur unpredictably even in relatively calm conditions on a vessel at anchorage or proceeding at low speed.

It is for these reasons that SOLAS and the IMSBC Code incorporate provisions intended to ensure that only cargoes with sufficiently low inherent moisture content to avoid liquefaction are loaded. Strict adherence to these provisions is the only safe way of carrying these types of cargoes.

### SOLAS/IMSBC Code Regulations

SOLAS requires that the shippers of bulk cargoes provide the Master in writing sufficiently in advance of loading with information on any special properties of the cargo, including the likelihood of shifting, and for concentrates or other cargoes which may liquefy additional information in the form of a certificate on the moisture content of the cargo and its Transportable Moisture Limit (commonly abbreviated to TML).<sup>2</sup> Cargoes which may liquefy shall only be accepted when the actual moisture content is less than the TML.<sup>3</sup>

Unlike the FMP, which can be determined in the laboratory, the TML is a parameter that is calculated, rather than measured, as 0.9 times the FMP. Thus, for example, a cargo with an FMP of, say, 10 per cent (as determined in the laboratory) has a corresponding TML of 9 per cent, this being 0.9 times 10 per cent.

Thus, the maximum allowed moisture content of a cargo at the time of loading (the TML) is lower than the moisture content at which liquefaction actually occurs (the FMP). This difference between the TML and the FMP is intended to provide a safety margin to protect against variations in moisture or FMP throughout the cargo and to allow for measurement uncertainties in the laboratory determination of moisture and FMP. It is essential that this safety margin is always preserved and thus cargoes should never be accepted if the moisture content exceeds the TML, regardless of by how much.<sup>4</sup>

Full details on the underlying testing and sampling procedures for shippers' certification obligations under SOLAS are given in the IMSBC Code 2009 (and previously in effectively identical form in its predecessor, the BC Code 2004).<sup>5</sup> In brief, the IMSBC Code specifies the following:

#### 1) Identification of hazard

Prior to start of loading, the shipper must declare to the Master in writing



Flow table test.

whether or not the cargo offered for loading is a cargo that may liquefy.<sup>6</sup> This is a very important part of the shippers' obligation to provide appropriate cargo information, as it is not necessarily obvious from the cargo name or from a visual inspection of the cargo whether the cargo may liquefy, and thus whether the Master should insist on a declaration of moisture and TML prior to allowing the cargo to be loaded. In principle, any bulk cargo that contains at least some moisture and at least some fine particles is at risk of liquefaction. The IMSBC Code specifies that all such cargoes should be submitted for laboratory testing to establish whether or not they possess flow properties.<sup>7</sup> If such testing shows that the cargo possesses a flow moisture point, then shippers must provide a certificate of moisture and of TML prior to loading, regardless of whether or not the cargo is specifically listed by name in the IMSBC Code as a cargo that may liquefy.

#### 2) Certification of moisture content

The declaration of moisture content must contain a statement from shippers that this is the average moisture content of the cargo at the time the declaration is handed to the Master prior to start of loading.<sup>8</sup> One important consequence of this is that the entire cargo must already be available at the load port to be sampled prior to start of loading, rather than be delivered piecemeal throughout a protracted loading process. The moisture content determination must be carried out on truly representative test samples of the entire cargo.<sup>9</sup> This is an elaborate process requiring full access to the cargo and careful planning to ensure

the moisture content of the test sample is truly the average moisture content of the entire consignment.<sup>10</sup>

Sampling for moisture content must take place not more than seven days prior to loading. Additional check tests should be conducted if there is significant rainfall between sampling and loading.<sup>11</sup>

Shippers must declare the moisture content separately for each cargo hold of the vessel, unless sampling has shown that the moisture content is uniform throughout the entire consignment.<sup>12</sup> In concentrates, the moisture content is often sufficiently uniform, but in unprocessed ores such as iron ore fines and nickel ore, the moisture content can vary significantly throughout the consignment and thus separate hold-by-hold moisture declaration is required. In actual shipping practice, few if any shippers do declare a hold-wise moisture content even in highly non-uniform cargoes, and this is a cause for concern.

If more than one distinct type of cargo is loaded commingled in the same cargo hold, e.g., if loading is from different stockpiles from a different source of supply or with different exposure to rain, then shippers must provide separate certificates for each type of cargo in each cargo hold. Similarly, shippers must carry out separate sampling and certification for each substantial portion of material which appears to be different in characteristics or moisture content from the bulk of the consignment. The moisture content must be below the respective TML separately for each

distinct parcel of cargo. Any portions that are shown to have a moisture content above the TML should be rejected as unfit for shipment.<sup>13</sup> Thus, if cargo is loaded from more than one source, it is not sufficient for the average moisture content of all of the cargo in each hold to be below the TML. One important consequence of this is that it is not possible to compensate for the loading of a batch of excessively wet cargo by then loading additional drier cargo into the same cargo hold.

### 3) Certification of TML

As discussed above, the TML is derived mathematically from a laboratory determination of the FMP. In principle, there are several different alternative test methods to determine the FMP: three of them are described in full detail in Appendix 2 of the IMSBC Code and the competent authority of the exporting country may approve additional test procedures.<sup>14</sup> In actual shipping practice, the only test method that is in widespread use is the flow table method, as described in paragraphs 1.1.1 to 1.1.4 of Appendix 2. While the test method is not difficult, it contains a subjective element and needs to be carried out by an experienced analyst who is familiar with the early signs of liquefaction in a test sample. The critical part is the ability to reliably identify a flow state in the test sample using the criteria given in the Code.<sup>15</sup> It is a matter of some concern that laboratories testing iron ore fines in India and nickel ore in Indonesia and the Philippines depart in many important respects from the IMSBC Code test procedure without approval from the respective competent authorities and without conducting systematic inter-laboratory comparisons to establish consistency of their results with laboratories using the unmodified IMSBC Code method.

For most processed ores, such as concentrates, the TML depends mainly on the technical details of the concentration process and does not vary significantly between shipments. For these cargoes, it is sufficient if shippers carry out a TML test once every six months. However, if the composition or characteristics of the cargo are variable between successive shipments for any reason, then a new TML test is required each time.<sup>16</sup> Unprocessed ores such as iron ore fines and nickel ore vary greatly in composition not only from shipment to shipment but also within each individual shipment. Thus, for these cargoes, shippers must carry out a new TML test for every single cargo being loaded.

Close adherence to the above

requirements of the IMSBC Code is essential in order to ensure that only cargoes that are safe for ocean transport are loaded. The IMSBC Code places the burden of certification on shippers, not on the Master. Without accurate information and certification being provided by shippers, the Master can not independently assess whether or not the cargo offered for loading is safe to carry. This is because it is impossible to determine from a visual inspection or from ad hoc sampling of cargo being delivered to the vessel whether or not the moisture content of a cargo is below the TML. Cargoes with moisture above the TML typically look much the same as cargoes with moisture below the TML. Clearly discernible alarm signals, such as separation of free water on the cargo surface or muddy appearance of the cargo, are only visible during loading when cargoes have a grossly excessive moisture content.

### Unprocessed ores - Iron ore fines and nickel ore

There is a wide range of mineral cargoes that may liquefy, and they vary in their appearance and physical properties. One sub-group of cargoes has a particularly dangerous combination of risk factors, and accounts for a large proportion of recent casualties, near misses and contentious load port disputes during carriage of cargoes that may liquefy.

The cargoes in question are unprocessed ores, the most widely-encountered of which are iron ore fines, mainly exported from India, and nickel ore, mainly exported from Indonesia, the Philippines and New Caledonia. Unlike concentrates, these are simply dug out of the ground in open-cast mines in mineral-rich, and often remote, locations and are presented for ocean transport with little or no processing. Thus, where concentrates have a highly uniform particle size and physical consistency, unprocessed ores are very heterogeneous, consisting of a mixture of fine-grained ore, clay-like material, pebble-sized stones and the occasional larger lump.

For shipowners contemplating carriage of these cargoes, and for Masters instructed to load them, a major difficulty is that neither iron ore fines nor nickel ore have a specific listing in the IMSBC Code and thus it is not immediately obvious from consulting the Code that these are indeed cargoes that may liquefy. Unless he is already aware of the potential hazards from other sources, the Master is dependent on shippers correctly declaring the cargo as a liquefaction hazard. Although most shippers do

indeed acknowledge that the cargo is a liquefaction hazard by supplying a moisture and TML certificate, albeit frequently flawed, some shippers do not, and without expert knowledge it is difficult for the Master to know that he should insist on a declaration of moisture and TML before allowing loading to commence.

Implementing a sampling and testing regime that complies with the provisions of SOLAS and the IMSBC Code, as summarised above, is a technically much more demanding task for unprocessed ores than it is for concentrate cargoes. The IMSBC procedures were designed with concentrates in mind and therefore have an implicit assumption of uniform particle size and reasonably uniform moisture distribution throughout the entire cargo. Neither of these applies to unprocessed ores.

It is an unfortunate combination that although sampling and testing cargoes of unprocessed ores is a technically more demanding task than for concentrate cargoes, the shippers of these cargoes are typically relatively small operators often lacking in the knowledge, expertise and technical infrastructure, and sometimes the will, to comply with their SOLAS and IMSBC Code obligations. Because of the unprocessed nature of the cargo, shippers have only very limited control over moisture content and some shippers may not actually be able to supply cargoes that meet the SOLAS requirements.

Following are some of the technical issues that need to be considered by shippers when designing their certification procedures.

The physical composition of unprocessed ores varies significantly even within a single open cast pit, and even more so as most cargoes are mixtures of material dug out from several, and sometimes very many, individual pits, which may be distributed over a wide geographical area. As a result, the TML may vary greatly from one part of the cargo to another, but in an unsystematic and unpredictable manner, which does not allow to simply test each source of material separately.

The moisture distribution throughout each cargo is typically highly non-uniform. The material is already variable in moisture at the time it is dug out of the ground. Most mining locations are in tropical countries with frequent heavy rainfall and the cargoes are typically transported in open lorries/wagons and stored in open stockpiles

leading to unpredictable increases in moisture.

The IMSBC Code specifically states that the ubiquitous test method for TML determination, the flow table method, is unsuitable for materials containing particles above 7mm in size.<sup>17</sup> This creates a dilemma for laboratories testing unprocessed cargoes, which frequently contain pebble-like stones above that size. Nickel ore, in particular, often has a very high proportion of lumps above 7mm. Iron ore fines are generally somewhat finer, but some cargoes also have a significant proportion of lumps above 7mm. The most frequent workaround to avoid this problem is to screen out all particles above 7mm prior to analysis and to conduct the TML test only on the proportion that is below 7mm in size. When doing so, it is essential that the particles above 7mm are removed from both the sample submitted for TML testing and the samples used to certify the moisture content of the cargo. Failure to do so will systematically overstate the safety of the cargo and may therefore lead to cargoes being accepted for loading that are actually unsafe.

Because of the non-uniform nature of unprocessed ore cargoes, samples from every single cargo need to be submitted for laboratory TML testing. Shippers therefore need to have a suitably equipped and qualified laboratory close at hand for TML testing to achieve acceptable turnaround times between sampling and certification. This differs from shippers of concentrate cargoes, who only need to submit one sample every six months, and therefore do not find it onerous to courier samples to reputable laboratories overseas. TML testing is a specialised task, and there are few laboratories worldwide who have a track record of obtaining reproducible results and participating in inter-laboratory comparisons over many years. None of these are in the main exporting countries of unprocessed ores.

In India, shippers of iron ore fines used to ignore their SOLAS obligations to provide a TML certificate until quite recently. Independent laboratories offering TML testing have only started to operate in the country after the 2007 monsoons. Although there are now many laboratories in India, all of them were started quite recently and therefore there is little or no experience data available to assess their reproducibility and consistency with leading international laboratories. To date, there has been no centralised accreditation or inter-laboratory testing effort to establish the soundness of the test procedures used by Indian laboratories.

In Indonesia, the Philippines and New Caledonia, mining locations are typically very remote indeed, and loading takes place at natural anchorages close to the mines, well away from any sophisticated infrastructure. The mines therefore generally operate their own flow table for TML testing in their in-house laboratories rather than using independent laboratories. On closer scrutiny, many of these in-house laboratories have been found to be poorly equipped and to depart significantly, and sometimes grossly, from the test procedures set out in the IMSBC Code.

#### Footnotes

1 See article "Carriage of dangerous cargo - Questions to ask before you say yes" elsewhere in this issue of Gard News.

2 SOLAS, Chapter VI, Regulation 2, Para. 2.2.

3 SOLAS, Chapter VI, Regulation 6, Para. 2.

4 The difference between moisture content and TML is a frequent source of confusion, leading to nonsensical statements such as "The TML of the cargo increased because of rainfall". The TML of a cargo depends on the type and composition of the cargo, but is not affected by whether the cargo is wet or dry. The TML is similar to, say, a speed limit on a road. The speed limit does not depend on how fast you drive,

but you break the law if you drive faster than the speed limit.

5 The IMSBC Code may be applied voluntarily from 1st January 2009 and will become mandatory under the provisions of SOLAS from 1st January 2011.

6 IMSBC Code, Para. 4.2.2.2. The IMSBC Code classifies cargoes that may liquefy in cargo group A and requires shipper to declare the cargo group.

7 IMSBC Code, Appendix 3, Para. 2.1.

8 IMSBC Code, Para. 4.3.2.

9 IMSBC Code, Para. 4.4.1 to 4.4.4.

10 IMSBC Code, Para. 4.4.4.

Paras. 4.6.1 to 4.6.6 give a set of recommendations for concentrate stockpiles that specify the minimum number of sub-samples to be taken to make up the representative sample. For a cargo of (say) 40,000 MT a minimum of 160 sub-samples is required. For cargoes that are more inhomogeneous than concentrates, including iron ore fines and nickel ore, collecting a sufficiently large number of sub-samples is even more important than for concentrates.

11 IMSBC Code, Para. 4.5.2.

12 IMSBC Code, Para. 4.3.3.

13 IMSBC Code, Paras. 4.3.3 and 4.4.3.

14 IMSBC Code, Paras. 4.1.4 and 8.3.

Appendix 2 contains the actual test procedures to determine the FMP and TML, including the flow table method in Paras. 1.1.1 to 1.1.4.

15 IMSBC Code, Appendix 2, Paras. 1.1.4.2.3 and 1.1.4.3.

16 IMSBC Code, Para. 4.5.1.

17 IMSBC Code, Appendix 2, Para. 1.1.1.

# Intercargo publishes guide for the safe loading of nickel ore

Gard Alert,  
February 2012

The International Association of Dry Cargo Shipowners (Intercargo) has recently published the "Guide for the Safe Loading of Nickel Ore", which aims to explain, through use of a flow-chart, how nickel ore can be safely shipped, within limitations, whilst raising awareness of the serious problem of cargo liquefaction. It is targeted at the widest possible audience within the industry, including shippers, shipowners and masters.

In addition to a chart describing what to look for when loading nickel ore, the guide recommends that:

- Responsible shippers must not misrepresent cargoes. In order to provide accurate cargo declarations shippers should have in place procedures for sampling, testing and controlling moisture content of cargoes including procedures to

protect cargo on barges from any precipitation and water ingress.

- Responsible shipowners must check that the cargo documentation is provided as required in the IMSBC Code.
- Before fixing, chartering departments should refer to their own internal procedures regarding the acceptance of nickel ore cargoes.

Intercargo also points out that the so-called "can test" is insufficiently robust as a means of checking cargo safety on its own.

A copy of the guide can be found here: [http://www.gard.no/webdocs/Intercargo\\_Nickel\\_Ore.pdf](http://www.gard.no/webdocs/Intercargo_Nickel_Ore.pdf). We are grateful to Intercargo for their kind permission to reproduce the document.



## NICKEL ORE: STOP, THINK, VERIFY!





# Shifting solid bulk cargoes

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1998

## An explanation of the processes of dangers

Solid bulk cargoes can shift by sliding or liquefying, and whilst the factors involved in each of these processes are different, the potentially disastrous consequences are the same – listing or capsizing and/or structural damage.

Dense cargoes, e.g. ore concentrates, have by definition a relatively high mass to volume ratio, so even a small amount of shifted cargo can have a large mass. Coupled with the momentum generated by a moving vessel considerable forces can act upon the ship's structure. This force will be even greater when the cargo level within the hold is above the sea level outside the hold, so that the counter-acting force of buoyancy is absent. Add to this the frequent occurrence of multiple or repetitive shifts and the result can be excessive plate flexing increasing the risk of cracking and failure.

In terms of stability<sup>1</sup>, shifting cargo can have numerous consequences. The shift in cargo will cause a list if the cargo does not return to its original position with subsequent vessel movement. Apart from increased draft concerns, the angle at which the vessel is listed will, if uncorrected, become that about which the vessel rolls. This will usually mean that the righting lever for angles of heel towards the side the vessel is listed will be less than that when the vessel is heeled from her upright position, which in turn means that the force returning the vessel from angles of heel beyond the angle of list, back to the same angle, will be less than the force returning the vessel to the upright had she not been listed. The angle of deck edge immersion will also be closer than that for an upright vessel and if this is reached stability will also be reduced. A list will also tend to subject the vessel to greater angles of heel and this may give rise to a domino effect causing other cargo and objects to break securings and/or to shift. Solid bulk cargoes that shift from one side of the vessel to the other with the rolling of the vessel, that is to say, cargoes behaving like a liquid in a part-filled tank, will also give rise to a Free Surface Effect, and this again will reduce the vessel's stability in a similar way to

that described above. The gravest consequence of shifting is capsize of the vessel, and this can happen when multiple shifts occur with little return of cargo to original positions. This process can be very quick and obviously disastrous.

Sliding occurs when the cohesive strength, or "stickiness" of the cargo, is insufficient to withstand the effects of rolling. Cohesive strength varies according to moisture content and the height of the stockpile. A good illustration of this is provided by sand. Wet or dry there is a limit on the height of a pile of sand, but damp sand tends to permit a higher sand pile. A common example of a cargo prone to sliding is grain<sup>2</sup>, which is particularly free flowing. The International Maritime Organisation (IMO) Code of Safe Practice for Solid Bulk Cargoes 1991 states (at para 5.2.4.2) that "non-cohesive bulk cargoes having an angle of repose<sup>3</sup> less than or equal to 30 degrees flow freely like grain and should be carried according to the provisions applicable to the stowage of grain cargoes". The stowage and carriage of grain is governed by the IMO Grain Rules 1982 which set out a number of requirements including specific stability criteria. There is also some industry authority to support a theory that sliding can also occur when, due to downward moisture migration, a saturated base layer (which need not be liquefied) is formed allowing the upper, relatively drier layer, to move against it.

Liquefaction of solid bulk cargoes depends on particle size and distribution as well as moisture content. The former determines whether moisture can drain freely through the cargo, and will obviously change during a vessel's voyage due to vibration, rolling, pitching and twisting. The effect of this movement is to break down lumps of cargo and reduce the space between particles – effectively compacting the cargo. Moisture can then become trapped between cargo particles and if there is sufficient saturation a flow state can develop. The point at which this occurs is called the Flow Moisture Point (FMP) and is usually expressed as a percentage of the moisture content. The IMO Bulk

Cargo Code referred to above adopts what is known as the Transportable Moisture Limit (TML), and this is the maximum moisture content of a cargo deemed safe for carriage by sea in ships other than "specially designed ships". It is defined as 90 per cent of the FMP. Cargoes prone to liquefaction are those with a small particle size and those which contain moisture as a result of the way they are processed before loading, e.g. iron ore concentrates and coal slurry or duff<sup>4</sup>.

It is perhaps worth mentioning here that solid bulk cargoes are increasingly being carried in Intermediate Bulk Containers (IBC)<sup>5</sup>. The Association's experience with this type of carriage suggests that the dangers of shifting cargo can be just as real. Solid bulk cargoes which are prone to sliding have been known to force the sides of even rigid IBC's to move and if there are gaps within the stow, or the sides of the stow are insufficiently shored, a general collapse of the stow can occur.

## A case example - Liquefaction of scale dust

An increasingly common solid bulk cargo is dust, commonly originating from industrial chimneys. Industry has for some time been required to limit the pollutants discharged into the environment and to this end chimneys can be installed with filters. The material collected by these filters is generally termed filter dust; material which builds up on the inner chimney surfaces also gives rise to another type of dust – scale dust. The contents of these substances vary enormously and chemical hazards are often associated with them. This is one of the reasons why many societies in our greener world no longer allow them to be left stored and forgotten on open slag heaps or in land-fill sites. The option to be considered in many of today's societies is re-cycling and it is this which has, to some extent, led to the water transport of dust.

The problems and dangers of watery filter dust were last mentioned in Gard News Edition 104<sup>6</sup>, and a recent case involving scale dust suggests to us that these problems and dangers are not fully understood and that essential precautions are not being adhered to.

The vessel in question loaded at Algeciras, Spain, and the scale dust in bulk was to take up most of her centre hold. The majority of the scale dust was noted by the master to be in open storage on land, unprotected from the elements, and on closer examination, was found to have a high moisture content in parts. Whilst the master was concerned as to the state of the cargo, loading commenced, and since this took place during periods of rainfall, moisture levels increased. No documents were produced by the shippers to record the properties of the scale dust, and when the master did raise concerns with the various cargo interests, including their surveyors, he was told that the loading of the cargo during rain, and the wetting of the cargo, was normal and of no importance with regard to the quality of the cargo.

The loading of the cargo seemed to be completed without further event or protest and clean bills of lading were issued. On the loaded passage the vessel encountered moderately heavy weather, causing heavy rolling and pitching at times. Four days into the passage a series of splashing and banging noises were heard which seemed to come from the hold containing the scale dust. Inspection of this hold revealed that the scale dust had become fluid and was splashing violently against the hold sides. The inspection itself was not without danger as a 5 – 6 metre geyser erupted from the booby hatch opened for inspection. The resultant mess on the ship's superstructure was the least of the worries facing the master as shortly afterwards the vessel took on a list. Fortunately the vessel was able to compensate for this by careful and strategic ballasting and was able to reach the discharge port without further serious incident.

Further inspection at the discharge port revealed that the forces involved with the shifting of the liquefied scale dust had resulted in the penetration of the cargo into an adjacent hold under and above a moveable transverse grain bulkhead. Problems ensued with the consignees who held the vessel liable for loss and damage to the cargo and the extra costs of discharging and storing the fluid cargo. The surveyors appointed by the owners learnt that the surveyors appointed on behalf of shippers, had issued a "certificate" of the moisture content at the loading port and given this to the consignees, but not to the master. The certified moisture content was said to be in the region of 11 per cent but tests at the discharge port determined a moisture content of nearly double this figure.

### Lessons learned and precautions to be taken

It is perhaps fair to say that the above vessel was fortunate to have completed her voyage without more serious incident. Having read the case summary, the reader will probably be able to find a number of areas where essential additional precautions could have been taken. Outlined below are a number of points which should be considered when contemplating the loading of solid bulk cargoes suspected of having a propensity to shift.

- (1) Carry out a visual examination of the cargo and enquire as to the extent and duration of exposure to moisture (unprotected stowage on wet ground or in wet weather).
- (2) Obtain and keep safe ship's own samples (the quantity should be sufficient for any necessary tests and be properly labelled and recorded etc). Do not just accept shippers' samples, unless these are taken in your/your representatives' presence.
- (3) Request in advance of the vessel's arrival, the shippers' declarations with regard to FMP, stowage factor, TML, moisture content, angle of repose, any chemical hazards and details which may require safety precautions to be taken<sup>7</sup>. If such documentation is not forthcoming it should be demanded and a letter of protest to shippers and charterers should be issued. The master can and should refuse to load the cargo if the documentation is still not forthcoming<sup>8</sup>. Remember that each individual cargo is unique. Details of cargoes previously carried, even if from the same origin, should not be relied on.
- (4) Check the details of the shippers' declaration carefully. The details should be accurate at the time the certificate is issued and the combination of a pre-dated declaration and suspected exposure to further moisture since the date of the certificate should raise concern. Some ports have rain gauges to assist in the quantitative assessment of the effects of rainfall on moisture content after certificates have been issued. If suspicions are raised, the shipper should be requested to perform the necessary tests. In any event, loading should not commence again until the vessel itself is satisfied that the cargo can be transported. It may be necessary for the ship to perform its own tests<sup>9</sup>. Do not be led astray by shippers proclaiming that all is fine and normal and that the cargo quality will be unaffected. This is not a quality issue, it is a safety issue.
- (5) In any event, cargoes with a moisture content above the TML should not be shipped. Remember that it may only be necessary to reject parts of the cargo, but this should raise concern as to the safety of the remaining cargo.

(6) The cargo space should be filled as much as is practicable, but always within stability, stress and deck loading constraints. A part-filled compartment is more prone to shifting and has greater space in which to allow shifting.

(7) Longitudinal separation (e.g. temporary bulkheads), and overstowing (e.g. bulk bundles) can be effective in limiting the distance cargo can shift, the shift amount and forces involved. Expert advice is recommended to ensure that these measures are appropriate. In addition, overstowing may not be appropriate, and shifting forces are often underestimated thus risking the failure of longitudinal separation.

(8) Cargo stows should be trimmed level right out to all sides of the cargo compartment. It is appreciated that trimming has its disadvantages, e.g. increased time and cost at load and discharge ports. However, it has more important advantages. Apart from reducing the possibility of cargo shift, weight distribution and stability are improved.

(9) Do not stow other cargoes containing moisture in same compartment.

(10) Do not load during rain. If this cannot be avoided have the moisture content re-tested to ensure that it complies with point 5 above (it should be noted that some cargoes can be damaged by exposure to moisture).

(11) If possible, adjacent tanks to the compartment concerned should be empty. If they cannot be made empty, extra care should be taken to ensure that watertight integrity is intact. This recommendation also applies for the whole compartment; hatch covers in particular should be closely examined and tested (hose/chalk/day light tests).

(12) The vessel should not be too stiff in terms of her stability as this will cause the vessel to roll quickly and perhaps violently. In saying this, the vessel needs an adequate metacentric height taking into account all the various factors which can lead to a reduction in this during the voyage.

(13) Bilges should be clean and empty, strums or rose boxes should be clear and lumber boards, where fitted, should be intact. Bilge well grilles should be covered with burlap. The pumps and bilges should be tested in all respects (particularly alarms and non-return valves) prior to loading. Soundings are to be taken at regular intervals during the voyage and bilges pumped as necessary. Concerns as to the effect of cargo weight loss due to moisture removal are understood, but again there are more important concerns. To protect owners' position it is recommended that a record is made of the amounts of moisture removed via the bilges, and this can be done by soundings.

(14) Weather routing is recommended in order to avoid heavy weather and/or sustained periods of it.

(15) Always consult the relevant IMO/flag state/port state/company codes/guidelines/recommendations. Port states in particular may impose stricter rules than those adopted internationally, e.g. with regard to the TML.

(16) If in doubt and assistance is needed, the Association is always on hand.

In conclusion, shifting solid bulk cargoes can be costly, not least in terms of money, but people's lives. The dangers are real and are not to be ignored – precautions need to be adhered to.

## Footnotes

1 For a guide to the basic principles of transverse stability (including definitions used in this article) please refer to the article in Gard News Edition 145, March 1997 (pages 14–18).

2 The term grain includes wheat, maize, oats, rye, barley, rice, pulses and seeds.

3 The angle which the cargo naturally, and of its own accord, makes with the horizontal.

4 The IMO Code of Safe Practice for Solid Bulk Cargoes 1991 (as amended) lists some commodities which may liquefy.

5 An IBC may be described as a disposable or re-usable receptacle designed for the carriage of bulk commodities in parcels of 0.5 to 3.0 tonnes. They can be of rigid (e.g. fibre board) or flexible (e.g. bags) construction.

6 December 1986 (page 13).

7 As of 1st January 1994 it became a SOLAS requirement for the shipper to provide this type of information. See International Convention for Safety of Life at Sea 1974 (as amended) Chapter VI, Part A and specifically Regulation 2.

8 Charterers are obliged to load only

safe cargoes and without the necessary documentation this can not be determined. Laytime disputes may arise and it is recommended that charterparties expressly stipulate that time lost due to non-production of the necessary documentation and/or due to reasonable measures taken by the ship where the accuracy of document details is reasonably suspected, is to be counted as laytime. Diversion to a port of refuge may also be necessary and it is recommended that charterparties make provision for charterers to bear the costs and consequences of this where caused without the owners' negligence.

9 The IMO Code of Safe Practice for Solid Bulk Cargoes 1991 sets out the tests and procedures.

# The carriage of nickel ore from the Philippines and Indonesia - The insurance position

Gard News 197,  
February/April 2010

Advice should be sought regarding the position under the P&I and hull and machinery policies before agreeing to carry nickel ore from certain ports.

The previous article in this issue of Gard News, by Brookes Bell, identifies the potential problems and dangers facing a shipowner who is asked to load a cargo of nickel ore in the ports and places mentioned in that article. Any owner who is asked to load such a cargo is recommended to contact Gard in relation to either their P&I cover or their hull and machinery cover, or both if both are placed with Gard, for advice as to the position under the relevant insurance policy(s) if it is decided to load the cargo on offer.

Each case will be considered on its own merits, but some general comments can be made. Firstly, it is essential that a shipowner identifies accurately and informs the insurers of

the nature and characteristics of the cargo his ship will be carrying. Rule 7 of Gard's P&I Rules for Ships deals with a situation where the risk is altered. A similar rule concerning hull and machinery insurances can be found in §§ 3-8 to 3-13 of the Norwegian Marine Insurance Plan. It seems clear from Brookes Bell's article that a ship may be invited to load cargo with characteristics which have either been misdeclared by the shippers, or which can not be ascertained accurately by the tests which have, according to the shippers, been performed. In such circumstances, it is likely that Gard will take the view that the risk being assumed by an owner who, nevertheless, agrees to load such a cargo is altered.

Rule 74 of Gard's P&I Rules (Unlawful trades, etc.) may also be relevant insofar as the loading and carriage of misdeclared nickel ore can be

considered to be an "unlawful, unsafe or unduly hazardous trade or voyage".

Furthermore, and although not stated explicitly in Gard's P&I Rules, it is a condition of cover that any dangerous cargo is carried in full compliance with the IMO Code of Safe Practice for Solid Bulk Cargoes (the BC Code). Similarly, the BC Code may be considered as a safety regulation in relation to hull and machinery policies, whereby a breach of the Code may affect cover. See for instance § 3-22 and § 3-25 of the Norwegian Marine Insurance Plan. The circumstances described by Brookes Bell indicate clearly that the insufficient and/or inaccurate testing performed by the shippers and the resulting inability on their part to accurately state the characteristics of the cargo as required by the BC Code mean that such requirements will almost certainly not have been met.

# Cargo liquefaction - An update

Gard News 205,  
February/April 2012

Solid bulk cargo liquefaction continues to be a hot topic for P&I Clubs and their Members. There have been several recent developments on which to update readers.

## Background

The topic of cargo liquefaction gained prominence in Gard News in the early part of 2010<sup>1</sup> and since then Gard has dealt with a large number of enquiries and requests from Members to arrange precautionary surveys. Despite the well-publicised potential dangers, it appears that market forces are driving ships to carry cargoes that may liquefy and weak freight markets may make it difficult for owners and charterers to pass up employment opportunities.

Since early 2010, Clubs in the International Group of P&I Clubs (IG Clubs) have issued circulars alerting Members to the dangers and problems of iron ore fines shipped from India as well as nickel ore shipped from Indonesia and the Philippines.<sup>2</sup> Concerns have also arisen with regard to other cargoes and countries of shipment, such as sinter feed from Brazil,<sup>3</sup> chromite ore and mill scale. The problems are often exacerbated by commercial pressures, and in difficult market conditions, owners will feel under greater pressure from charterers and shippers seeking to persuade owners to avoid extra costs and delays, such as may be caused by owners' own surveys and tests on cargo waiting to be shipped. Various charterparty clauses have been seen in circulation that attempt to weaken, avoid, and/or restrain owners' ability to take appropriate and necessary precautions, such as those set out in the aforementioned Circulars. This resulted in the IG Clubs recently producing a standard charterparty clause to assist owners in trying to resist commercial pressures that could lead to the International Maritime Solid Bulk Cargoes Code (the IMSBC Code) provisions and precautions related thereto being compromised.<sup>4</sup>

## The heart of the problem

Members may well ask why they should go through the time, cost and trouble of arranging their own survey, sampling and analysis of cargo, when

it is the shippers who are obliged under the IMSBC Code to declare that a consignment is fully and accurately described, that their given test results are correct to the best of their knowledge and are representative of the cargo to be loaded. The answer, and what lies at the heart of the problem, is inaccurate declarations and certificates from shippers. This may range from cargo being mis-declared as Group C (i.e., cargo not liable to liquefy), to inaccurate FMP (flow moisture point)/TML (transportable moisture limit) figures and/or moisture content. Judging by what has been reported at IMO level, this appears to have had disastrous consequences in some cases where it is likely that ships and crews had relied on declarations/certificates being accurate. In 2010 the IMO issued a circular<sup>5</sup> referring to two serious casualties in the monsoon season of 2009 and many near-misses on ships engaged in the carriage of iron ore fines. In that circular the IMO stated: "some shippers have in the past declared iron ore fines as iron ore, which is a Group C cargo". This was followed by the loss of 45 seafarers and three vessels carrying nickel ore from Indonesia and a submission by China to the IMO in March 2011 which stated that "According to the evidence available, the direct cause of these accidents was the loss of stability as a

result of cargo liquefaction and shift in bad weather. However, the cargo documentation provided to the masters indicated that the moisture content of the cargo samples was lower than the Transportable Moisture Limit (TML)".

Market forces appear to be driving ships to carry cargoes that may liquefy.

The reasons behind inaccurate declarations and certificates are numerous and in Gard's experience these can range from a complete lack of knowledge that the IMSBC Code exists, a lack of understanding of the IMSBC Code, improper sampling and analysis procedures/equipment and even deliberate manipulation of samples/test results. The latter is particularly concerning and may arise because shippers are unwilling or unable to provide cargo with a moisture content below the TML because to do so would require an investment in time/costs to remove moisture. This may particularly be the case where cargoes are simply shipped straight from the ground without any processing.

## Other problems and complications

Whilst unreliable shippers' declarations and certificates may be at the heart of the problem, this is complicated by several other problems, some of which are discussed below.



Market forces appear to be driving ships to carry cargoes that may liquefy.

### Successful shipment history

A number of shippers and charterers are quick to point out that many cargoes have successfully reached their destination without incident and without owners having arranged their own precautionary sampling and analysis. There may be numerous reasons for this, such as the fact that cargoes are rarely homogenous in all holds, as well as the weather and sea conditions. Some voyage orders have been known to advise masters to avoid heavier seas/weather, which is rather impractical and ignores the fact that conditions can not always be accurately forecast, particularly at a local level. Perhaps a significant factor is that the TML is set at 90 per cent of the FMP, in other words there is a 10 per cent safety margin. A cargo may therefore have a moisture content above the TML, but not so high as to reach the FMP. All this said, it is fair to say that the precise reasons why some cargoes liquefy and some do not are not fully understood. It is reasonable to assume that the IMSBC Code has been drafted with this in mind. Sadly, it would seem that numerous shippers and indeed some owners do not feel obliged to comply with the IMSBC Code. It is not uncommon to hear that, following the rejection of cargo by one owner, the very same cargo is loaded onto another ship.

### Sampling

The IMSBC Code includes provisions for sampling and there is often a problem obtaining sufficiently representative samples. Owners are often refused access to shore stockpiles, if indeed there are any, as some cargoes are taken directly from the ground and loaded to the ship. Even if access to stockpiles is given, shippers may not make clear which stockpiles will be used to load the vessel. The number of samples required

for analysis also presents a logistical challenge (especially if the laboratory is located overseas). For example, for a stockpile of 50,000 MT, sampling according to the IMSBC Code requires 200 samples to be taken and then combined to at least 50 sub-composite samples. Owners trying to avoid delays by making early survey arrangements can also face the problem that, according to the IMSBC Code, the time interval between moisture content testing and sampling shall not be more than seven days. If unprotected cargo is affected by precipitation between testing and loading, further sampling and analysis would be required. It is also worth mentioning here the danger of Members and their crews over-relying on 'can tests'. Whilst these may indicate if cargo is unfit for shipment they can not determine if a cargo is fit to be loaded - this can only be determined by proper laboratory testing. To make this clear, one of the revisions to the IMSBC Code agreed at the 16th Session of IMO Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC 16) was to make clearer the limitations of the 'can test' by adding to the IMSBC Code a statement that "If samples remain dry following a can test, the moisture content of the material may still exceed the Transportable Moisture Limit (TML)".

### Testing

Some shippers have questioned whether the tests recognised by the IMSBC Code are suitable for certain cargoes, particularly if they have a larger particle size and/or the cargo consists of only a small portion of fine material that may liquefy. Experts advising Gard and the IG have been able to successfully test numerous cargoes, using the different test methods, with reasonable consistency. The lack of independent laboratories that are competent to perform testing,

especially with regard to the FMP/TML, is also a problem, not just in the country of shipment, but world-wide. With many competent laboratories located outside the country of shipment there can be significant delays and costs. Often owners take the decision to start loading pending laboratory analysis results, but this can also lead to complications if such analysis shows the cargo to be unsafe. However, a lot of good work has been done, notably in India, where industry experts have witnessed proper testing in a number of independent laboratories, often through training by the very same experts.

The on-board rectification of cargo moisture levels is far from straightforward.

### Cargo already loaded

If cargo is loaded and subsequent concerns arise as to its fitness for safe carriage, there is the obvious problem of identifying within the bulk what parts of the cargo are unfit. Often, therefore, the whole bulk has to be discharged. However, it can be extremely difficult to get cargo re-discharged at the place of loading. This may be because of a lack of facilities to take cargo back: in some remote locations cargo is bulldozed into barges from ashore and whilst cargo can be off-loaded to barges with the ship's cranes, shippers may have a problem getting it back ashore. There may also be complications caused by local customs regulations, which may consider a cargo to be exported once loaded. Quite often, when owners find their ships with unsafe cargo on board, lawyers are instructed and legal battles with charterers and others ensue. The on-board rectification of cargo moisture levels is far from straightforward. Many attempts, using various techniques, have been carried out but with limited success, particularly in holds that are full.



The on-board rectification of cargo moisture levels is far from straightforward.

### P&I cover

Whilst Gard does not see the P&I cover as a complication or problem as regards liquefaction issues, Members may benefit from the clarification given below.

Gard has taken the decision not to afford cover for the cost of precautionary surveys. Some say that such surveys are a measure to avert or minimise loss. Subject to certain provisos, Gard's Rule 46 provides cover for "extraordinary costs and expenses reasonably incurred on or after the occurrence of a casualty or event for the purpose of avoiding or minimising any liability on the Association". Whilst it is

debatable whether any event has taken place at the time a precautionary survey is requested, the key point in Gard's view is that the primary purpose of such surveys is to confirm that the cargo is safe for carriage and not to minimise any liability on the Club.

In addition, Gard's Rule 8 provides that "it shall be a condition of the insurance of the Ship that... the Member shall comply or procure compliance with all statutory requirements of the state of the Ship's flag relating to the... safe operation... of the Ship". The IMSBC Code is part of SOLAS (a statutory requirement) and under SOLAS the master has an overriding duty and authority not to load the cargo or to stop the loading of the cargo if he has any concerns that the condition of the cargo might affect the safety of the ship.

It should also be borne in mind that bulk carriers are not the only ships that carry dangerous cargo. Container ships carry many dangerous goods and the Club can not be expected to pay for surveys to check that the numerous dangerous cargoes are safe for carriage. For similar reasons as those outlined above, P&I cover is unlikely to respond to the cost of discharging an unsafe cargo.

So what costs does Gard cover? Clearly, the carriage of these cargoes may give rise to various claims for which Defence cover may be available, including survey costs in connection with such claims and incurred with prior approval from Gard. Cover may also be available if a survey is subsequently used in the defence of a claim that is covered by P&I. That brings us to the more difficult issue of Club cover where a Member does not follow the recommendations made by the Club, notably those set out in the International Group of P&I Clubs circulars. As stated in those circulars "...if a Member fails to comply with the [IMSBC] Code or local regulations when not in conflict with the Code, they should also be aware that they might be prejudicing Club cover. All of the Group Clubs have similar Rules which in essence exclude cover for liabilities, costs and expenses arising from unsafe or unduly hazardous trades or voyages".<sup>6</sup> Until such time as Gard or the IG Clubs may decide to take a stricter line, Gard's approach has been to forewarn Members that there is a grave risk of losing cover<sup>7</sup> if the Member knowingly carries unsafe cargo, for example where independent test results on samples show a moisture content in excess of TML. Members are also at significantly greater risk of prejudicing cover if unsafe cargo is loaded without any checks, or if the

Member loads unsafe cargo from a country where there is a history of unreliable shippers' certificates, doing so solely on the basis of 'can tests' and without independent sampling and analysis.<sup>8</sup> Of course, much depends on the facts of each case and there are likely to be a number of facts (notably whether or not the cargo is unsafe and/or the shipper's certificates are accurate) unknown to the Club at the time cargo is presented for shipment and Members seek the Club's position on cover.

Gard's view is that it essentially boils down to a question of risk which one Member may be prepared to take, but which at a certain level, the mutual membership of the Club can not reasonably be expected to share. Is it right that an owner who does not follow the recommended precautions, thus avoiding time, trouble and cost, should get the same level of cover as one who does?

### Cargoes not listed in the IMSBC Code

The fact that a number of cargoes that may liquefy, such as nickel ore and iron ore fines, are not listed in the IMSBC Code causes uncertainty. However, the IMSBC Code recognises (in section 1.3) that some cargoes that may liquefy may be not be listed in it. The IMSBC Code also states that "many fine-particled cargoes, if possessing a sufficiently high moisture content, are liable to flow. Thus any damp or wet cargo containing a proportion of fine particles should be tested for flow characteristics prior to loading".<sup>9</sup> In addition, Group C cargoes are defined in the IMSBC Code as cargoes not liable to liquefy and Group A cargoes are defined as cargoes which may liquefy. The words emphasised tend towards a more cautious approach, which given the potentially disastrous consequences, is wholly appropriate.

At the 16th Session of the IMO Sub-Committee on Dangerous Goods, Solid Cargoes and Containers it was agreed, as a matter of principle, that if a cargo may liquefy it should be categorised as Group A. As mentioned above, section 1.3 of the IMSBC Code deals with cargoes not listed in the IMSBC Code and if such a cargo may liquefy the IMSBC Code requires preliminary suitable conditions for carriage to be set by three competent authorities, i.e., those in the port state of loading, the flag state of the ship and the port state receiving the cargo. Gard has yet to see any such 'tripartite agreement' issued in respect of nickel ore or indeed iron ore fines (despite IMO circular DSC.1/Circ.66 recognising that iron ore fines are not listed but may liquefy).

### Local pressures

Mention has already been made of commercial pressures. There are also local pressures, despite the fact that some states, such as India, have taken the problem seriously and introduced national regulations in support of the IMSBC Code. For example, a circular recently issued by one Indian port authority, concerned with the effect of loading stoppages on berthing schedules, required the production by the owners' P&I surveyor of test certificates together with a statement by the surveyor that the cargo was fit for loading. The circular went on to suggest that if, despite such certificates, vessels subsequently stopped loading, surveyors' licences would be reviewed. This is a good example of the pressures that local surveyors often face, not least since such pressure may cause them to believe they are being asked to choose between their own livelihood and the lives of those on board ships. It is worth emphasising here that a surveyor appointed by the Club on behalf of the owners is not speaking for the Club itself. Neither the Club nor the owner can confirm whether or not a particular cargo is safe to carry and it is not their obligation to do so under the IMSBC Code. Owners should be aware that doing so could prejudice any potential recourse against a shipper/charterer were something to go wrong. Local tensions have also seen surveyors and experts, especially those from overseas, refused access to ports. Local authorities have also been known to have threatened legal action against the removal of samples from the country for testing overseas without their prior approval (which is unlikely to be given anyway).

### What is being done to address the problems?

Alerting Members to the problems and dangers has been a priority in the past year. Members have then been able to raise the level of awareness within their own organisations and with long term business partners. Whilst Gard tries to lend as much support to its Members as it can, this is an industry problem that needs to be addressed at a national and international level.

### National level

As already mentioned, some states have recognised the problems and dangers of liquefaction and have taken action. For example, The Indian government, through the Directorate General of Shipping (DGS), has issued a number of Merchant Shipping Notices which generally support the IMSBC Code. China is also understood to be in the process of drafting regulations. It is of course important for national provisions to be in uniformity with the

internationally agreed IMSBC Code. Where they broadly are, these can be powerful points of reference for shippers attempting to compromise safety. A number of states have also made submissions to the IMO, with various suggestions being made to address the problems (see below).

### International level

Industry bodies, including the International Group of P&I Clubs, have attended numerous meetings in the past year which recently culminated in joint industry papers being submitted to the 16th Session of the IMO Sub-Committee on Dangerous Goods, Solid Cargoes and Containers. That session included a meeting of a Working Group on Amendments to the IMSBC Code, including the evaluation of properties of solid bulk cargoes. The meeting was attended by state and industry representatives and on 22nd September 2011 it reported on measures to improve safe transport of cargoes that may liquefy. These measures are considered in more detail in the article "Future IMSBC Code amendments regarding cargoes that may liquefy", which appears elsewhere in this issue of Gard News.

### What can owners do in practice?

One might say that the IMSBC Code already provides a sufficiently sound basis on which to safely transport solid bulk cargoes that may liquefy. The agreed amendments to the IMSBC Code, which seem unlikely to come into effect until 2013 at the earliest, should serve to strengthen the precautions to be taken, notably by shippers. Ultimately, however, much depends on shipper compliance and if there is insufficient confidence in the reliability of shippers' declarations and certificates, owners and their Clubs will be hesitant to relax their own precautions. So this is what owners can do, practically speaking:

### Know what to expect

- Understand the problems and complications, such as those mentioned above.
- Chartering and operations departments and most importantly ships' crews should be aware of the dangers and precautions.
- If they are not satisfied the cargo is safe to carry, owners should be ultimately prepared to sail without cargo and to deal with the consequences (safer than the alternative).

### Pre-fixture/order

- If the vessel is on time charter, check whether the cargo is permitted under the charterparty. Consider excluding it given the time/trouble/costs/risks involved.
- If owners are prepared to carry these cargoes (in accordance with the IMSBC Code) discuss the owners' expectations with the charterer well in advance.
- Try to incorporate into the contract the charterparty clause recommended by the International Group of P&I Clubs.
- Do not accept any charterparty clauses that may compromise the IMSBC Code or prevent owners' appointment of certain surveyors/experts.

### At fixture/order

- Demand proper declaration of the cargo and its Bulk Cargo Shipping Name.
- Consult the IMSBC Code.
- Make swift contact with Gard for guidance on specific cargoes/countries so that sampling and independent testing can be arranged to try and minimise delay.
- Seek to clarify any improper declarations/certificates with charterers before the vessel arrives at the load port.
- Remember that the master will need support/help locally and that this can take time (sometimes days) to arrange.

### Before loading

- Demand the proper IMSBC Code documentation, including the shipper's declaration and certificates of moisture content and TML/FMP.
- Check shipper's documents against the provisions of IMSBC Code.
- Do not accept for loading any cargo or parts of cargo until it has been properly tested and documented as safe to carry in accordance with the IMSBC Code.
- Support the master's overriding authority under SOLAS not to load the cargo or to stop the loading of the cargo if he has any concerns that the condition of the cargo might affect the safety of the ship.

### Conclusion

Inaccurate declarations and certificates from shippers appear to be at the heart of the problem with the transport of cargoes liable to liquefy, though it is recognised there are numerous complications. Whilst factors causing liquefaction may not be fully understood, the IMSBC Code adopts a cautious approach, which is wholly appropriate, given the potentially disastrous consequences. Until such

time as the risks of liquefaction in a given cargo can be identified with more certainty, the role of authorities in the ports of loading is vital to ensure that shippers comply with the IMSBC Code. If they do not, owners and their P&I Clubs will have no option but to continue to take their own precautions. Owners who choose to run risks, calculated or otherwise, may have to face the consequences on their own.

### Footnotes

- 1 See for instance the article "Liquefaction of unprocessed mineral ores - Iron ore fines and nickel ore" in Gard News issue No. 197.
- 2 See Gard P&I Member circulars No. 16/10 (iron ore fines) and No. 23/10 (nickel ore).
- 3 See Gard Loss Prevention Circular No. 6/11.
- 4 See Gard Alert of September 2011.
- 5 DSC.1/Circ.66 (revised in 2011).
- 6 Gard's Rule 74 states: "The Association shall not cover liabilities, losses, costs or expenses arising out of or consequent upon the Ship carrying contraband, blockade running or being employed in or on an unlawful, unsafe or unduly hazardous trade or voyage".
- 7 In respect of for liabilities, costs and expenses arising out of carrying unsafe cargo or out of non-compliance with the IMSBC Code.
- 8 Unless an independent expert customarily advising the Club/IG can confirm that the shipper's documents are in accordance with the IMSBC Code and acceptable based on representative samples and proper analysis from a competent laboratory.
- 9 Section 2.1 of Appendix 3.

# Cargo liquefaction problems – sinter feed from Brazil

Loss Prevention Circular  
No. 06-11

Several Members have reported problems with sinter feed cargoes loaded in Brazil. The ports of Ponta da Madeira and Santana have featured most prominently thus far.

## Sinter feed and liquefaction

Sinter feed is an iron concentrate containing fine particles and moisture and, being similar to iron ore fines, is at risk of liquefaction, resulting in cargo shift and loss of stability. Liquefaction is believed to have resulted in numerous casualties, causing the loss of many seafarers' lives. This year two International Group Member Circulars have been issued, alerting Members to the dangers of liquefaction and the precautions to be taken, specifically with reference to iron ore fines and nickel ore.

## Problems

The Association is aware of at least one case where shippers have declared sinter feed as a Group C cargo (not liable to liquefy) under the IMSBC Code. This is in clear contravention of the Code since sinter feed is classed as a Group A cargo (under the group entry "Mineral concentrates") which may liquefy if shipped at a moisture content in excess of its Transportable Moisture Limit ("TML"), and defined in the Code as 90% of the Flow Moisture Point, ("FMP"). There are also reports of lack of local survey capacity, with surveyors reportedly acting for shippers as well as shipowners – a clear conflict of interest, a lack of reliable testing facilities able to test for the FMP in accordance with the methods set out in the Code. Shippers are also presenting cargo to load from stockpiles that have not been sampled/analysed.

Problems are exacerbated by heavy rainfall increasing the moisture content of the cargo. As described in the above circulars, the 'can' test is not meant to replace or supersede laboratory testing which is the responsibility of the Shippers. Section 8 of the Code states that if the sample shows signs of liquefaction, i.e. flat surface with evidence of free moisture, arrangements should be made to have additional laboratory tests conducted on the material before it is accepted

for loading. Cargo should never be accepted on the basis of the 'can' test alone. The test may indicate if the cargo is unfit for shipment but cannot determine if a cargo is fit to be loaded – this can only be determined by laboratory testing. Given an apparent lack of reliable testing facilities in Brazil, expert advice has recently seen samples sent as far as the UK for testing, which can obviously result in serious delays. It is worth emphasising here the importance of avoiding the loading of cargo and parts of the cargo which have not been properly tested and documented as safe to carry in accordance with the Code as it can be difficult to discharge cargo once it is loaded, not to mention the practical difficulty of identifying "unsafe" parts of the cargo that may have to be discharged.

## Survey costs and P&I cover

The primary purpose of surveys in respect of cargoes such as sinter feed, iron ore fines and nickel ore, is to confirm safe carriage. For that reason, the Club does not cover the survey costs and neither are they considered a measure to avert or minimise loss, since if Members act in accordance with the Code and satisfy themselves as to safe carriage there should be no undue exposure under the P&I cover. The survey costs may, however, be covered in full or part if the survey is actively used in defence of a P&I claim.

The Club will assist Members faced with these problem cargoes as best we can. However, it is important to point out that, if a Member fails to comply with the Code they may be prejudice Club cover. Rule 74 of Gard's Rules excludes cover for liabilities, costs and expenses arising from an unsafe or unduly hazardous trade or voyage. The carriage of these cargoes may give rise to various claims for which Defence cover may be available, including survey costs in connection with such claims which have been incurred with the prior approval of the Club.

## Advice and precautions

Members should carefully consider the potential costs/risks of carrying this cargo before entering into new fixtures

and, if the cargo is not excluded, to try and incorporate provisions that pass on responsibility to charterers. If a Member does fix to carry sinter feed they are advised to refer to the precautions set out in International Group Circular No. 16/2010.

## Footnotes

- 1 Gard News 197 Feb/Apr 2010 "Liquefaction of unprocessed mineral ores - Iron ore fines and nickel ores".
- 2 See Gard Member Circulars Nos. 16/2010 and 23/2010.
- 3 Described in section 8 of the IMSBC Code as a spot check a Master can conduct if he is suspicious of the condition of the cargo



# Liquefaction of cargoes of iron ore

Loss Prevention Circular  
No. 08-10

## Background

Members may be aware of the problems that have arisen in recent times with respect to the liquefaction of cargoes of iron ore fines originating in India and loaded at Indian ports. However, similar problems have been experienced in the past with similar cargoes elsewhere in the world and, as such, these cargoes must always be treated as liable to liquefy regardless of their origin.

Liquefaction of mineral ores, resulting in cargo shift and loss of stability, has been a cause of some major marine casualties for many decades. However, a spate of incidents leading to several losses in recent times involving iron ore fines loaded in Indian ports has led to considerable focus on the lack of compliance with the requirements for safe carriage of this cargo. There have also been incidents involving cargoes of nickel ore from Indonesia, the Philippines and New Caledonia.

The Southwest Monsoon generally prevails from June to September and mainly affects India's west coast. The Northeast Monsoon generally prevails from December to March and mainly affects India's east coast. The advent of the Southwest Monsoon gives us good reason to revisit this subject through this circular.

## Main causes of casualties

The main cause of the casualties and near misses appears to be the poor compliance of some shippers with the testing and certification requirements that are required under SOLAS and the IMSBC Code 2009 and designed to ensure that cargoes are loaded only if the moisture content is sufficiently low to avoid liquefaction occurring during the voyage. Indian iron ore fines tend to be left in the open prior to shipment, and as a consequence, are entirely subject to weather conditions during this period. The problems related to wet cargo and its moisture content particularly worsen during the wet monsoon seasons.

In cargoes loaded with a moisture content in excess of the Flow Moisture Point (FMP), liquefaction may occur unpredictably at any time during the voyage. Some cargoes have liquefied and caused catastrophic cargo shift almost immediately on departure from the load port, some only after several weeks of apparently uneventful sailing. While the

risk of liquefaction is greater during heavy weather, in high seas, and while under full power, there are no safe sailing conditions for a cargo with unsafe moisture content. Liquefaction can occur unpredictably even in relatively calm conditions on a vessel at anchorage or proceeding at low speed.

Given this unpredictability, it is of utmost importance that the length of voyage and prevalent and forecasted weather conditions do not serve to encourage the carriage on ships of cargoes prone to liquefaction with a Transportable Moisture Limit in excess of that which is accepted as safe for carriage. It is for these reasons that SOLAS and the IMSBC Code incorporate provisions intended to ensure that only cargoes with sufficiently low inherent moisture content to avoid liquefaction are loaded. Strict adherence to these provisions is the only safe way of carrying these types of cargoes.

## Preventive measures

Based on previous experiences with respect to cargoes of iron ore fines loaded from India, Members are advised to exercise extreme caution when loading such cargo on their vessels. It is important that cargoes of iron ore fines unsuitable for shipment are identified and rejected before coming onboard the vessel and proper measures are taken to ensure that the cargo loaded on board complies with SOLAS and meets the requirements of the IMSBC Code. Additional sampling will be required if the cargo is subject to sources of moisture during loading.

Although the IMSBC Code places the burden of certification on the shipper, in many cases the information contained in the certificates may be incorrect. This may be due to failure to correctly analyse the samples, or use of facilities not geared to properly test the samples, or the test samples not being properly representative of the cargo to be loaded. It is thus extremely important that the ship owner and master ascertain that the cargo is suitable for sea transport.

Although exposure to moisture is heightened during the monsoon seasons, ship owners should ensure that the same level of caution is exercised with respect to the loading of iron ore fines irrespective of the time of the year. The Association strongly recommends Members to contact the local correspondent or the Association in

good time to assist them in engaging the services of a competent and experienced surveyor to act on the Member's behalf to assist the master both before and during loading operations in order to ensure that the cargo is loaded in compliance with SOLAS and that the IMSBC Code is adhered to.

## Freight disputes

Although not directly connected with the safe transport of iron ore fines from India, this seems like an opportune time to highlight this issue.

We understand that some Chinese ports do not allow the discharge of low grade iron ore without an import permit. This can cause considerable delay of vessels and disputes concerning, e.g. freight, demurrage or deadfreight may arise in relation to iron ore from India.

We understand that "China Chamber of Commerce of Metals Minerals and Chemicals Importers and Exporters" and "China Iron & Steel Association" notified their members in April of this year to stop importing iron ore with an Iron (Fe) content below 60%. This has made it difficult to obtain import permits from the government through these two Associations.

It is therefore recommended that before transporting Indian iron ore or iron ore with less than 60% Fe content from other countries into China, shipowners should check with the Charters/ Shippers/Cargo Receivers if the Chinese buyers have obtained the import permit so as to avoid unnecessary disputes over freight, demurrage and detention of vessels. Similar caution should also be exercised with respect to spot cargoes of low grade iron ore into China.

See Gard Loss Prevention Circular No. 10-07: Loading of iron ore fines in India.

Liquefaction of cargoes of Iron ore has also been addressed in Gard News 197 (Feb/April 2010) "Liquefaction of unprocessed mineral ores – Iron ore fines and nickel ore", by Dr. Martin Jonas, Brookes Bell, Liverpool. The article describes the SOLAS/IMSBC Code Regulations, Certification of TML / moisture content and principles of liquefaction.

We are grateful to "Hai Tong and Partners" of Beijing, China for providing the information with respect to the Freight disputes.

# India - Safe Shipment of Iron Ore Fines from Indian Ports

International Group Member  
Circular No. 16/2010

## Introduction

As Members may be aware in 2009 two ships, the 'Asian Forest' and the 'Black Rose', capsized and sank following liquefaction of iron ore fines cargoes which they had loaded in the Indian ports of Mangalore and Paradip. There have been other incidents of liquefaction, particularly when loaded during or after the Indian monsoon season, resulting in ships becoming unstable and being forced to seek refuge. In other cases cargoes loaded have been found to have moisture content in excess of the Transportable Moisture Limit (TML) prior to the vessel's departure and the ships in question have been prevented from sailing by the local port authorities until the situation has been rectified leading to substantial delays.

The Indian Government through the Ministry of Shipping, Directorate General of Shipping (DGS) conducted enquiries into the sinking of the ships and established a Committee to look into the safe loading and carriage of iron ore lumps and fines from Indian ports. The DGS has issued a number of Merchant Shipping Notices, the latest of which is M Notice No. 9 of 2010, dated 27th August 2010. The Group is in dialogue with the DGS on a number of issues arising from the M Notices and how they relate to the International Maritime Solid Bulk Cargoes Code (the Code). M Notice No. 9 is being made law in India as part of the new Carriage of Goods Regulations.

The Indian Government also submitted a report to the 87th session of the IMO Maritime Safety Committee (MSC) in May 2010 reporting on the findings of its investigation into the two casualties and the actions that the Indian authorities had taken following the casualties together with various recommendations relating to the carriage of iron ore fines. The report was considered by the 15th session of the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC) in September 2010. The DSC issued a Circular DSC.1/Circ 63 which sets out a number of conclusions and recommendations relating to the carriage of iron ore fines.

In view of the incidents referred to it is most important that Members ensure that all local and international

requirements including those under the Code, relating to the loading, stowing, carriage and discharge of iron ore lumps and fines cargoes loaded at Indian ports are fully complied with.

## International Maritime Solid Bulk Cargoes Code (IMSBC Code)

The Code is issued under SOLAS 1974 and its Protocols, which have been incorporated into the Indian Merchant Shipping Act 1958 (as amended). The Code sets out the internationally agreed provisions for the safe stowage and shipment of solid bulk cargoes, including cargoes that may liquefy, such as iron ore fines. Those cargoes not specifically listed are covered by Section 1.3 of the Code. It is currently advisory but becomes mandatory internationally on 1 January 2011. However in India it is already mandatory by virtue of M Notice No 9.

Regulation VI/2, SOLAS 1974 requires the shipper to provide the master or his representative with all relevant information relating to the cargo sufficiently in advance of loading to enable precautions which may be necessary for the proper stowage and safe carriage of the cargo to be put into effect.

Section 4 of the IMSBC Code sets out the obligations and responsibilities imposed on the shipper for providing information about the cargo.

Most importantly for cargoes that may liquefy (Group A cargoes), certificates should be provided evidencing the moisture content of the cargo at the time of shipment and the transportable moisture limit (TML). The TML is defined in the Code as 90% of the Flow Moisture Point (FMP). The FMP can only be determined by laboratory analysis of cargo samples. Any cargo with moisture content in excess of the TML should not be accepted for loading (unless on specially constructed or fitted ships). Iron Ore fines does not have its own schedule in the Code but should be regarded as being a Group A cargo.

### (A) Master's Obligations

The master or his representative should monitor the loading operation from start to finish. Loading should

not be commenced until the master or the ship's representative is in possession of all requisite cargo information in writing as described above. The master has an overriding authority under SOLAS not to load the cargo or to stop the loading of the cargo if he has any concerns that the condition of the cargo might affect the safety of the ship.

### (B) Shipper's Obligations

#### (1) Cargo Information

The shipper must provide the master or his representative in writing with all information and documentation required under the Code in sufficient time before loading to ensure that the cargo can be safely loaded onto, carried and discharged from the ship (section 4.2.1).

#### (2) Documentation

The documentation must include:

- (a) a certificate/declaration certifying the moisture content of the cargo loaded in each of the ship's holds together with a statement that to the best of the shipper's knowledge the moisture content is the average moisture content of the cargo.
- (b) a certificate certifying the TML of the cargo together with the FMP test result prepared by a competent laboratory.

The Code requires that the interval between testing for the Flow Moisture Point (FMP) and loading be no more than six months for regular materials unless the production process is changed in any way and the interval between testing for the moisture content and loading shall never be more than seven days. However with irregular materials such as iron ore fines every shipment should be checked. Masters should be wary of moisture content certificates provided by the shipper's laboratory and moisture content percentages that are very close to the TML. If there is significant rain between the time of testing and the time of loading the shipper must conduct test checks (section 4.5.2) to ensure that the moisture content of the cargo is still less than its TML.

### (3) Laboratories

The shipper must identify the laboratory used to conduct the tests on the cargo samples. It is recommended that masters check with the local correspondents/appointed surveyors to ensure that the laboratory is reputable and competent. The number of such laboratories in India is currently very limited.

### (4) Stockpiles

The shipper must identify the stock piles from which the cargo is to be loaded and confirm in writing that the samples tested and in respect of which certificates have been issued/declarations made originated from those stock piles.

### (5) Barges

Where barges are used to transport cargo to the ship they must be capable of being individually identified by the master/ship/ appointed surveyor.

Problems encountered with the shipment of iron ore fines from India

It is understood that Members have encountered a number of problems with shipments of iron ore fines from India, including:-

- Cargoes being mis-described to avoid application of the Code
- Iron ore fines not being declared as Group A cargo
- Certificates and declarations not being provided
- Inaccurate moisture content and TML certificates, resulting in unsafe cargo being presented for shipment
- Commercial pressure on masters not to delay shipment and to carry cargoes without the provision of accurate certificates
- Restrictive clauses in charterparties
- Cargo not being stock piled but delivered straight from the mine
- Only one certificate being provided when there is more than one distinct source of cargo
- Moisture content certification being over seven days old

### Recommended precautions

1. Loading should not be commenced until the master is in possession of all requisite cargo information and documentation/certificates that a shipper is obliged to provide under the Code or local regulations and is satisfied that the cargo is safe to load and carry.

2. Following consultation with the Association, appoint a surveyor on behalf of the ship in advance of loading to assist the master. It may in any event be a local requirement to do so. However, it should be made clear to the port and competent authorities, shippers and charterers that the appointment of a

surveyor by the ship is not intended to and does not relieve the shipper of his obligations under the Code or local regulations.

The terms of the surveyor's appointment should include the following:

- (a) To assist the master with compliance with his obligations under the Code and local regulations.
- (b) To contact and liaise with shippers to identify the stockpiles from which the cargoes are to be shipped on the subject vessel and to ensure that representative samples are correctly taken in accordance with sections 4.4 and 4.6 of the Code.
- (c) To take owners' own representative samples for testing in an independent competent laboratory.
- (d) To liaise with an independent expert to ensure that the laboratory conducts its tests in accordance with Appendix 2 of the Code.
- (e) To compare the shipper's certificates with owners' own test results for TML and moisture content. Masters should be wary of moisture content certificates provided by the shipper's laboratory and moisture content percentages that are very close to the TML. If there is significant rain between the time of testing and the time of loading the shipper must conduct test checks.
- (f) To monitor the loading operation from start to finish, paying particular attention to the weather conditions and the presence of any moist cargo, particularly in barges.
- (g) To stop loading if further moisture and/or can tests are conducted, as necessary, on any parts of the cargo presented for shipment (sections 4.5.2 and 8.4 of the Code).
- (h) To monitor the stockpiles and/or barges to ensure that the cargo presented for shipment is from the designated and tested stockpiles and/or barges. This will involve keeping a careful tally and identification of barges offered for loading.
- (i) To ensure loading is suspended during periods of rain.
- (j) To carefully examine cargo offered for loading from uncovered barges and if in any doubt of the moisture content conduct 'can' tests particularly when rain has been experienced. The 'can' test is described in section 8 of the IMSBC Code as a spot check a Master can conduct if he is suspicious of the condition of the cargo, and is not meant to replace or supersede laboratory testing which is the responsibility of the Shippers. Section 8 states that if the sample shows signs of liquefaction - i.e. flat surface with evidence of free moisture, arrangements should be made to have additional laboratory tests conducted on the material before it is accepted for loading. Nevertheless

cargo should never be accepted on the basis of the 'can' test alone. The test may indicate if cargo is unfit for shipment but cannot determine if a cargo is fit to be loaded – this can only be determined by laboratory testing.

3. If the master or his appointed surveyor is presented with any document seeking their confirmation that the cargo is safe to carry they should refuse to sign it. The obligation under the Code is on the shipper to declare that the cargo is safe to carry and signing such a document could prejudice a Member's rights of recourse against a shipper in the event of a subsequent casualty.

4. Report any commercial pressure to the Association so that this may be taken up by the Group with the DGS.

5. Members should consider how they might protect themselves contractually before agreeing to carry iron ore fines cargoes, e.g. including an appropriate clause in any charterparty. Equally Members should not be pressurised into entering into charterparties which restrict their right to fully apply the provisions of the Code, appoint independent surveyors of their choice or take and test cargo samples.

6. Members should refer to the Club any contractual and/or safe carriage concerns it may have relating to the iron ore lumps and fines loaded in India

Consequences of a Member's failure to comply with the Code

The risks of loss of life, damage to the environment and loss of property are only too apparent, but if a Member fails to comply with the Code and/or local regulations they should also be aware that they might be prejudicing Club cover. All of the Group Clubs have similar Rules which in essence exclude cover for liabilities, costs and expenses arising from unsafe or unduly hazardous trades or voyages.

All Clubs in the International Group of P&I Clubs have issued a similar Circular.

Any questions with regard to the above may be addressed to Nick Platt or Mark Russell in Gard (UK) Limited (Tel: +44 (0) 20 7444 7200).

Yours faithfully,  
GARD AS



Claes Isacson  
Chief Executive Officer

# Indonesia and the Philippines – Safe Carriage of Nickel Ore Cargoes

## Introduction

As members may be aware in October and November 2010 three vessels the 'Jian Fu Star', 'Nasco Diamond' and 'Hong Wei' sank during the carriage of nickel ore from Indonesia to China with the loss of forty four seafarers. The cause of the sinkings has not yet been definitively determined but nickel ore, like iron ore fines and many concentrates, is a cargo which may liquefy, if the moisture content of the cargo exceeds the Transportable Moisture Limit (TML) when loaded. Liquefaction of such a cargo can result in loss of stability which in turn can lead to a vessel capsizing. It is therefore very possible that all three vessels were lost as a result of cargo liquefaction.

There have been a number of other recent reports of cargoes of nickel ore loaded in both Indonesia and the Philippines liquefying and causing loss of stability to the carrying vessel but fortunately not resulting in the loss of the vessel. In one such case the carrying vessel grounded causing extensive hull damage. Currently nickel ore is only loaded in four locations in the Philippines, Santa Cruz (Luzon), Surigao and Tubay (Mindanao) and Rio Tuba (Palawan Island).

Liquefaction of some ore cargoes can be caused by the normal incidents of a sea voyage, for example the motion of the ship in the seaway or vibrations caused by the running of the main engine or other on-board machinery.

The International Group informally raised its concerns about the loading and carriage of nickel ore from Indonesia and the Philippines, with the Indonesian and Philippine delegations that attended the 88th session of the IMO Maritime Safety Committee (MSC) which was held between 24 November and 3 December 2010. Intercargo made an intervention at that session expressing its concerns with respect to the hazards and risks associated with the carriage of cargoes that can liquefy such as nickel ore. In addition Intercargo pointed out that some charterers and masters had been put under extreme pressure to accept shippers' declarations and testing

reports without having been permitted the opportunity of independently verifying such declarations and reports. The Marshall Islands supported Intercargo's intervention and the Indian delegation outlined the actions that the Indian authorities were taking to improve the safe carriage of iron ore fines cargoes loaded in India.

## Specific Concerns Associated with the Loading and Carriage of Nickel Ore

The loading and carriage of nickel ore cargoes from both Indonesia and the Philippines has given rise to the specific concerns set out below.

(a) Most mines are situated in remote locations and loading/port facilities are therefore non-existent or very limited and loading equipment and methods rudimentary. Cargo is stock-piled, uncovered, on the beach and accordingly totally exposed to the prevailing weather conditions.

(b) The traditional practice has been to ship nickel ore cargoes in the dry season, between February and May/June when rainfall in past years was negligible. However in recent years anecdotal evidence suggests that the distinct demarcation between the wet and dry seasons has been substantially eroded and heavy rainfall is now experienced during the dry season. The stock-piles do not therefore benefit to the same extent from solar-drying as in the past.

(c) The mines are not easily accessible due to their remoteness and it is therefore difficult for independent surveyors/experts acting for the vessel to attend the mines and take samples of the cargo to be loaded.

(d) There are few, if any, independent laboratories in Indonesia and the Philippines. The mines generally have their own laboratories but it is often not possible to determine whether the correct testing equipment is available and in a satisfactory condition or whether they are following the procedures laid down under the International Maritime Solid Bulk Cargoes Code (the Code) when testing

cargo samples. Such audits as it has been possible to carry out of mines equipment and testing and sampling procedures suggest not. Accordingly the reliability of the information and documentation which the shipper is required to provide under the Code which became mandatory internationally on 1/1/11, most notably the Transportable Moisture Limit (TML) certificate and the Flow Moisture Point (FMP), is questionable.

(e) The composition and physical properties of nickel ore vary considerably from location to location. Since the cargo is not homogenous it is difficult to accurately determine the TML and moisture content of the cargo as a whole. Frequently shippers will only provide one TML certificate for a cargo that has been drawn from a number of different sources and is not homogenous, which is contrary to the Code.

(f) Nickel laterite has high clay content. Because of this, testing the FMP of a sample using the usual flow table method can be subjective and the results questionable. If the flow table method of testing is not suitable, section 1.1.1 of the Code provides that the procedures to be adopted should be those approved by the relevant authority of the Port State.

(g) Vessels are invariably loaded whilst at anchor from barges or landing craft which have themselves been loaded from stockpiles situated on the beach. The stock-piled cargo may well have been subject to rainfall after samples have been taken and tested, during transportation from the mine to the beach and while stockpiled on the beach. The Code requires that the interval between testing for the moisture content and loading shall never be more than seven days but in many instances this period is not observed.

(h) There have been a number of reports of surveyors appointed on behalf of vessel interests to take cargo samples and conduct independent testing, being subject to extreme pressure by shippers to accept the

results of the tests carried out by the mines. In certain instances the 'pressure' has been nothing short of physical intimidation.

### International Maritime Solid Bulk Cargoes Code (IMSBC Code)

The Code is issued under SOLAS 1974 and its Protocols. The Code sets out the internationally agreed provisions for the safe stowage and shipment of solid bulk cargoes, including cargoes that may liquefy, such as nickel ore. Those cargoes not specifically listed are covered by Section 1.3 of the Code. It became mandatory internationally on 1 January 2011.

Regulation VI/2, SOLAS 1974 requires the shipper to provide the master or his representative with all relevant information relating to the cargo sufficiently in advance of loading to enable precautions which may be necessary for the proper stowage and safe carriage of the cargo to be put into effect.

Section 4 of the IMSBC Code sets out the obligations and responsibilities imposed on the shipper for providing information about the cargo.

Most importantly for cargoes that may liquefy (Group A cargoes), certificates should be provided evidencing the moisture content of the cargo at the time of shipment and the transportable moisture limit (TML). The TML is defined in the Code as 90% of the Flow Moisture Point (FMP). The FMP can only be determined by laboratory analysis of cargo samples. Any cargo with a moisture content in excess of the TML should not be accepted for loading (unless on specially constructed or fitted ships). Nickel Ore does not have its own schedule in the Code but should be regarded as being a Group A cargo.

#### (A) Master's Obligations

The master or his representative should monitor the loading operation from start to finish. Loading should not be commenced until the master or the ship's representative is in possession of all requisite cargo information in writing as described above.

The master has an overriding authority under SOLAS not to load the cargo or to stop the loading of the cargo if he has any concerns that the condition of the cargo might affect the safety of the ship.

#### (B) Shipper's Obligations

##### (1) Cargo Information

The shipper must provide the master or his representative in writing with all information and documentation required under the Code in sufficient

time before loading, to ensure that the cargo can be safely loaded onto, carried and discharged from the ship (section 4.2.1).

##### (2) Documentation

The documentation must include:

(a) A certificate/declaration certifying the moisture content of the cargo to be loaded together with a statement that to the best of the shipper's knowledge the moisture content is the average moisture content of the cargo. Where a cargo is to be loaded into more than one cargo space, the certificate or declaration of moisture content shall certify each type of material loaded into each space, unless, following proper sampling and testing it is apparent that the different types are uniform throughout the whole consignment.

(b) A certificate certifying the TML of the cargo together with the FMP test result prepared by a competent laboratory. The Code requires that the interval between testing for the Flow Moisture Point (FMP) and loading be no more than 6 months for regular materials unless the production process is changed in any way and the interval between testing for the moisture content and loading shall never be more than 7 days. However with irregular materials such as nickel ore every shipment should be checked. Masters should be wary of moisture content certificates provided by the shipper's laboratory and moisture content percentages that are very close to the TML. If there is significant rain between the time of testing and the time of loading the shipper must conduct test checks (section 4.5.2) to ensure that the moisture content of the cargo is still less than its TML.

##### (3) Laboratories

The shipper must identify the laboratory used to conduct the tests on the cargo samples. However as stated above little reliance can be placed on the results of testing conducted by mine laboratories and samples should be the subject of independent testing by surveyors and experts appointed on behalf of the vessel.

##### (4) Stockpiles

The shipper must identify the stock piles from which the cargo is to be loaded and confirm in writing that the samples tested and in respect of which certificates have been issued/ declarations made originated from those stock piles.

##### (5) Barges

Where barges are used to transport cargo to the ship they must be capable of being individually identified by the

master/ship/appointed surveyor.

### Recommended precautions

1. Loading should not be commenced until the master is in possession of all requisite cargo information and documentation/certificates that a shipper is obliged to provide under the Code or local regulations (where not in conflict with the Code) and is satisfied that the cargo is safe to load and carry.

2. Considering the recent casualties mentioned above, members are encouraged to consider reviewing with the Managers steps that might be considered to reduce the risk presented by this cargo before loading and in any case, if the master is in any doubt as regards the suitability of the cargo for loading, very serious consideration should be given to the appointment of a surveyor on behalf of the ship in advance of loading to assist the master. However, it should be made clear to the competent authority (which, in the Philippines, is likely to be the Bureau of Mines), shippers and charterers that the appointment of a surveyor by the ship is not intended to and does not relieve the shipper of his obligations under the Code or local regulations (when not in conflict with the Code).

The terms of the surveyor's appointment should include the following:

(a) To assist the master with compliance with his obligations under the Code and local regulations (when not in conflict with the Code).

(b) To contact and liaise with shippers to identify the stockpiles from which the cargoes are to be shipped on the subject vessel and to ensure that representative samples are correctly taken in accordance with sections 4.4 and 4.6 of the Code.

(c) To take owners' own representative samples for testing in an independent competent laboratory which are likely to be located outside the country.

(d) To liaise with an independent expert to ensure that the laboratory conducts its tests in accordance with Appendix 2 of the Code.

(e) To compare the shipper's certificates with owners' own test results for TML and moisture content. Masters should be wary of moisture content certificates provided by the mines laboratories and moisture content percentages that are very close to the TML. If there is significant rain between the time of testing and the time of loading the shipper must conduct test checks.

(f) To monitor the loading operation from start to finish, paying particular attention to the weather conditions and the presence of any moist cargo in the barges/ landing craft.

(g) To stop loading if further moisture and/or can tests are conducted, as necessary, on any parts of the cargo presented for shipment (sections 4.5.2 and 8.4 of the Code).

(h) To monitor the stockpiles and/or barges to ensure that the cargo presented for shipment is from the designated and tested stockpiles and/or barges. This will involve keeping a careful tally and identification of barges/landing craft offered for loading.

(i) To ensure loading is suspended during periods of rain.

(j) To carefully examine cargo offered for loading from barges/landing craft and if in any doubt of the moisture content, conduct 'can' tests particularly when rain has been experienced. The 'can' test is described in section 8 of the IMSBC Code as a spot check a Master can conduct if he is suspicious of the condition of the cargo, and is not meant to replace or supersede laboratory testing which is the responsibility of the Shippers. Section 8 states that if the sample shows signs of liquefaction - i.e. flat surface with evidence of free moisture, arrangements should be made to have additional laboratory tests conducted on the material before it is accepted for loading. Nevertheless

cargo should never be accepted on the basis of the 'can' test alone as it is difficult to accurately interpret the behaviour of the sample in the can and accordingly its moisture content. The test may indicate if cargo is unfit for shipment but cannot determine if a cargo is fit to be loaded – this can only be determined by laboratory testing.

3. If the master or his appointed surveyor is presented with any document seeking their confirmation that the cargo is safe to carry they should refuse to sign it. The obligation under the Code is on the shipper to declare that the cargo is safe to carry and signing such a document could prejudice a Member's rights of recourse against a shipper in the event of a subsequent casualty.

4. Report any instance of commercial pressure exerted on or intimidation of the master, surveyor or experts to the Association so that this may be taken up by the Group with the Indonesian/ Philippine authorities.

5. Members should consider how they might protect themselves contractually before agreeing to carry nickel ore cargoes e.g. including an appropriate clause in any charterparty. Equally Members should not be pressurised into entering into charterparties which restrict their right to fully apply the provisions of the Code, appoint independent surveyors of their choice or take and test cargo samples.

6. Members should refer to the Club any contractual and/or safe carriage concerns it may have relating to nickel ore cargoes loaded in Indonesia or the Philippines

Consequences of a Member's failure to comply with the Code

The risks of loss of life, damage to the environment and loss of property are only too apparent, but if a Member fails to comply with the Code or local regulations when not in conflict with the Code, they should also be aware that they might be prejudicing Club cover. All of the Group Clubs have similar Rules which in essence exclude cover for liabilities, costs and expenses arising from unsafe or unduly hazardous trades or voyages.

All Clubs in the International Group have issued a similar Circular.

Any questions with regard to the above may be addressed to Nick Platt or Mark Russell in Gard (UK) Limited (Tel: +44 (0) 20 7444 7200 or Geir Kjebekk in Gard AS, Arendal (Tel: +47 37 01 91 00).

Yours faithfully,  
GARD AS



Claes Isacson  
Chief Executive Officer

# Dangers of carrying Nickel Ore from Indonesia and the Philippines – Mandatory Notification Requirements

International Group Member  
Circular No. 5/2012

## Background

This circular should be read in conjunction with the previous circular 23/2010: Indonesia and the Philippines – Safe Carriage of Nickel Ore Cargoes dated January 2011 relating to the safe carriage of nickel ore cargoes and nothing in this circular supersedes the previous advice. The liquefaction of such cargoes has resulted in the sinking of a number of ships with a loss of many lives in the last 18 months. Nickel ore is a cargo which may liquefy if the moisture content of the material exceeds its Transportable Moisture Limit (TML). Cargo liquefaction may lead to a loss of stability, to the extent that the ship may capsize.

Due to the numerous dangers and difficulties associated with this particular cargo, the International Group is actively involved with other industry bodies in discussions currently taking place within the International Maritime Organisation (IMO) to determine if and how the International Maritime Solid Bulk Cargoes (IMSBC) Code can be amended to improve the safe carriage of nickel ore cargoes. Representatives from the International Group also recently met with the Indonesian Administration in Jakarta, as part of an industry delegation, to discuss industry concerns with regard to the safe carriage of such cargoes from Indonesia. The issues discussed included the duty of a competent authority to oversee compliance by shippers of their obligations under the Code in respect of reliable testing and accurate certification of the cargo to be shipped. In the absence of an early resolution to these discussions and the on-going risks to safety, Members considering the carriage of nickel ore from ports in Indonesia and the Philippines should note the recommendations contained in this circular.

## Mandatory Notification Requirement

Whilst it remains the Members' responsibility to ensure full compliance with the IMSBC Code and to take any measures necessary to ensure the safe

carriage of nickel ore cargoes from ports in Indonesia and the Philippines, Members who plan to fix or charter a ship to load nickel ore from ports in Indonesia and the Philippines, or where under an existing fixture a ship is ordered to load such cargo, must contact the Managers at the earliest opportunity and, where possible, provide the following information:-

- Ship name
- Port/anchorage of loading and estimated time of arrival
- Date of intended loading
- Charterer/shipper's details
- Agent's details
- Copy of the shipper's cargo declaration and supporting certificates.

This will enable the Managers to provide Members with relevant information on measures that might be taken to reduce the risk, as set out in the previous circular, such as the appointment of a local surveyor to assist the Master, and the appointment of an expert, not necessarily to attend in person, but to liaise and supervise the local surveyor throughout. These measures may reduce the risks inherent in the carriage of nickel ore cargoes but are not a guarantee of safety.

If the Master is in any doubt whatsoever as regards the suitability and safety of the cargo then loading should be stopped. The Member should contact the Managers immediately. Problems are likely to arise if the loading of unsafe cargo is permitted. It may, for example, be difficult to discharge the cargo due to the lack of facilities in the loading port or complications arising from local customs regulations.

As experience is gained as a result of these mandatory declarations, the Managers aim to be in a better position to identify those areas, ports and shippers which present particular difficulties, including inaccurate cargo declarations.

## Possible Prejudice to Club Cover

Members should be aware that they may be prejudicing Club cover if they

fail to notify the Managers that they plan to fix or charter a ship, or that a ship has been ordered, to load nickel ore from a port in Indonesia or the Philippines.

## Conclusion

The objective of this notification procedure is to try and ensure Members engaged in or contemplating the carriage of nickel ore are made aware of the dangers, the IMSBC Code requirements, Club cover implications and also provided with information on measures available to mitigate these risks, even if they cannot be entirely excluded.

All Clubs in the International Group have issued similar circulars.

Any questions with regard to the above may be addressed to Nick Platt or Mark Russell in Gard (UK) Limited (Tel: +44 (0)20 7444 7200).

Yours faithfully,  
GARD AS



Claes Isacson  
Chief Executive Officer

# New BIMCO Charterparty clause for solid bulk cargoes that may liquefy

Gard Alert,  
July 2012

We refer to the Gard Alert "IMSBC Code - Charterparty clause for solid bulk cargoes that may liquefy" published in September 2011.

In the period following publication of the above Gard Alert, BIMCO and the International Group of P&I Clubs worked together and developed a new industry charterparty clause for solid

bulk cargoes that may liquefy. A key feature of the clause is that it requires charterers to provide owners with written evidence from the shippers that the moisture content of the cargo does not exceed the Transportable Moisture Limit (TML). The clause also allows the owners to take their own test samples of the cargo prior to loading and for the master to be able to refuse to accept the cargo (or to sail if already loaded).

Gard recommends that ship owners incorporate this clause into time charterparties that allow for the carriage of solid bulk cargoes that may liquefy and in voyage charterparties fixed for such cargoes. The new clause is quoted below and replaces the clause previously recommended by Gard.

## Solid Bulk Cargoes that Can Liquefy Clause for Charter Parties

(a) The Charterers shall ensure that all solid bulk cargoes to be carried under this Charter Party are presented for carriage and loaded always in compliance with applicable international regulations, including the International Maritime Solid Bulk Cargoes (IMSBC) Code 2009 (as may be amended from time to time and including any recommendations approved and agreed by the IMO).

(b) If the cargo is a solid bulk cargo that may liquefy, the Charterers shall prior to the commencement of loading provide the ship's Master, or his representative, with all information and documentation in accordance with the IMSBC Code, including but not limited to a certificate of the Transportable Moisture Limit (TML), and a certificate or declaration of the moisture content, both signed by the shipper.

(c) The Owners shall have the right to take samples of cargo prior to loading and, at Charterers' request, samples to be taken jointly, testing of such cargo samples shall be conducted jointly between Charterers and Owners by an independent laboratory that is to be nominated by Owners. Sampling and testing shall be at the Charterers' risk, cost, expense and time. The Master or Owners' representative shall at all times be permitted unrestricted and unimpeded access to cargo for sampling and testing purposes.

If the Master, in his sole discretion using reasonable judgement, considers there is a risk arising out of or in connection with the cargo (including but not limited to the risk of liquefaction) which could jeopardise the safety of the crew, the Vessel or the cargo on the voyage, he shall have the right to refuse to accept the cargo or, if already loaded, refuse to sail from the loading port or place. The Master shall have the right to require the Charterers to make safe the cargo prior to loading or, if already loaded, to offload the cargo and replace it with a cargo acceptable to the Master, all at the Charterers' risk, cost, expense and time. The exercise by the Master of the aforesaid rights shall not be a breach of this Charter Party.

(d) Notwithstanding anything else contained in this Charter Party, all loss, damage, delay, expenses, costs and liabilities whatsoever arising out of or related to complying with, or resulting from failure to comply with, such regulations or with Charterers' obligations hereunder shall be for the Charterers' account. The Charterers shall indemnify the Owners against any and all claims whatsoever against the Owners arising out of the Owners complying with the Charterers' instructions to load the agreed cargo.

(e) This Clause shall be without prejudice to the Charterers' obligations under this Charter Party to provide a safe cargo. In relation to loading, anything done or not done by the Master or the Owners in compliance with this Clause shall not amount to a waiver of any rights of the Owners.

For more information about the new clause please go to [www.bimco.org](http://www.bimco.org).

For a collection of Gard's previously published information on the topic of cargo liquefaction, please go to the "Cargo Liquefaction Spotlight" found under Preventing Losses on our website.



# IMSBC Code amendments regarding cargoes that may liquefy

Gard News 205,  
February/April 2012

Amendments to the IMSBC Code aiming to improve the safe transport of cargoes that may liquefy have been agreed by the IMO.

The article "Cargo liquefaction - An update", which appears elsewhere in this issue of Gard News, makes reference to works at the IMO during the past year which have culminated in joint industry papers being submitted to the 16th Session of IMO Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC 16). The session included a meeting of a Working Group on Amendments to the IMSBC Code whose report sets out a number of agreed amendments to improve the safe transport of cargoes that may liquefy, including the following:

- Clarification that the "competent authority" shall operate independently from the shipper. Amendments to the IMSBC Code aiming to improve the safe transport of cargoes that may liquefy have been agreed by the IMO.

- A requirement that the moisture content and TML (transport moisture limit) certificates be issued by an entity recognised by the competent authority of the port of loading.

- A requirement that the shipper has in place procedures for sampling, testing and controlling moisture content and for these procedures to be approved by the competent authority of the port of loading.

- A requirement that the shipper facilitates access to stockpiles for the purpose of inspection, sampling and subsequent testing by the ship's nominated representative.

## Iron ore fines

More specifically, the DSC 16 Working Group also agreed that an IMO Correspondence Group should develop a new schedule(s) for iron ore fines and to consider test methods. This Group, which is now functioning with input from industry, including the International Group of P&I Clubs (IG) and experts customarily advising the IG Clubs, will report to the next IMO DSC

Editorial and Technical Group meeting in March 2012. In the meantime, it was also agreed, albeit with resistance from industry (specifically those representing ship interests), that the existing DSC circular concerning iron ore fines would be revised. This circular (DSC.1.Circ/63, dated 7th October 2011) introduces what can best be described as a temporary definition of iron ore fines: a cargo "mainly constituted by iron bearing minerals with a size up to 6.35 mm". The revised circular also goes on to provide that "if there is a question about the applicability of this circular for a specific particle size distribution of iron ore, advice should be sought from the competent authority of the port of loading" and that "the Master should observe current best practice when handling and carrying this cargo, such as the use of specifically designed filters to protecting the cargo holds bilge covers to stop the ingress of this fine cargo into the bilge".

As mentioned, these revisions met with some resistance from industry, as it was felt somewhat premature to be making revisions to a 2010 circular pending the findings of the Correspondence Group. Several obvious questions also arise. How is the master supposed to make an appropriate assessment of particle size distribution and can the competent authority be relied on to make the correct assessment? What is a specifically designed bilge filter and who should approve it?

It is difficult to answer these questions here, but experts advising Gard and other IG Clubs take the view that bilge covers can not and do not avoid liquefaction and that particle size is not the issue - the issue is whether or not the cargo, or a part of it, may develop a flow state at a certain moisture content. Studies have shown that the potential to liquefy is principally governed by the behaviour of the very fine material in a cargo (1 mm in size and smaller), and not the sizing of the larger material. The presence of particles greater than 6.35 mm in the cargo does not automatically categorise the cargo as Group C. If it contains a proportion of fine particles under 1 mm it may be a Group A cargo, irrespective of particles

greater than 6.35 mm being present. If there is any doubt regarding whether a material is Group A or Group C, it should be submitted for testing for flow properties. Ultimately, the revisions to the circular may simply lead to more shippers trying to avoid declaring iron ore fines as Group A cargo and to more owners seeking expert advice on each cargo.

## Nickel Ore

With regard to nickel ore, a draft new schedule proposed by France categorising this cargo as Group A was accepted in principle by the Working Group and will be forwarded to the Editorial and Technical Group for further consideration.

## Ship design

It is also worth mentioning that the Working Group considered the issue of developing alternative requirements on the prevention of accidents through ship design. Further consideration of this and any stability mitigation measures following the occurrence of liquefaction were left for consideration by other IMO Committees. In July 2011 the Italian classification society RINA announced that it had "established rigorous design standards for the modification or newbuilding of dry bulk cargo carriers to enable them to carry fine ores safely at any moisture content.<sup>1</sup> It remains to be seen whether the cost of modification of existing ships (estimated at USD 3 million for a Supramax bulker) will be commercially feasible, as the number of modified new builds is unlikely to provide the capacity needed to meet world demand for a long time to come.

The agreed amendments to the IMSBC Code will probably only come into effect in 2013 at the earliest.

## Footnotes

<sup>1</sup> See [www.rina.org/en/news/press/\\_file/attacksnickel\\_eng.pdf](http://www.rina.org/en/news/press/_file/attacksnickel_eng.pdf).

# Brazil - liquefaction of bauxite cargoes

**Gard Alert,  
March 2012**

Gard has learned that several vessels have recently experienced cargo liquefaction problems after loading bauxite in the Amazon region in northern Brazil, apparently from terminals in Trombetas. To our knowledge, the exact causes of the incidents have not been reported so far, but it has been suggested that heavy rain in the region has led to an unusually high moisture content of the loaded bauxite. As far as Gard is aware, no serious consequences or casualties have resulted from the reported incidents, merely problems related to delays and extra costs in connection with the discharge operations.

Bauxite is a cargo which normally consists of lumps, with a relatively low moisture content. Due to these typical characteristics of the cargo, it is listed in

the IMSBC Code as a Group C cargo: a cargo not liable to liquefy. Appendix 1 of the IMSBC Code describes bauxite as a cargo with moisture content between 0% and 10% consisting of 70%-90% lumps varying in size between 2.5 and 500 mm and 10%-30% powder. If any of the properties listed in Appendix 1 of the IMSBC Code are not met, the requirements of section 1.3 of the Code, "Cargoes not listed in this Code", should be followed.

Liquefaction of mineral ores resulting in cargo shifting and loss of stability has been a major cause of marine casualties for many decades. In cargoes loaded with too high a moisture content, liquefaction may occur without warning at any time during the voyage. Some cargoes have liquefied and caused catastrophic shifting of cargo almost

immediately upon departure from the load port whilst others have liquefied after several weeks of apparently uneventful sailing. Members and clients loading bauxite from terminals in the Amazon region in northern Brazil should be aware of the potential costs/risks of carrying this cargo and ensure that it has been verified to be safe for carriage in accordance with requirements of the IMSBC Code. It is worth bearing in mind that seemingly safe cargoes can create dangerous situations.

For general advice Members and clients should also refer to Gard's compilation "Cargo liquefaction", which contains a collection of articles published by Gard over the years relating to the carriage of cargoes liable to liquefaction

# Bar, Montenegro - zinc concentrate liquefaction risk

**Gard Alert,  
June 2012**

Gard's correspondent in Genoa, Hugo Trumpy, has reported that, over the last months, some cargoes of zinc concentrate<sup>1</sup> presented for loading in Bar, Montenegro have been rejected due to high moisture content. The terminal has, reportedly, implemented measures such as using nylon tarpaulin covers to prevent wetting of the cargo by rain.

Members and clients loading zinc concentrate in Bar, Montenegro should be aware of the potential risks of carrying this cargo and should seek to ensure that it is safe for carriage in accordance with the requirements of the International Maritime Solid Bulk Cargoes (IMSBC) Code. Consideration should be given to the appointment of surveyors to take representative samples of the cargo and to arrange for tests to be conducted to determine

the accuracy of the transportable moisture limit (TML) and that the actual moisture content is below the TML. To our knowledge, there are currently no independent laboratories in Montenegro able to perform the tests required by the IMSBC Code and samples must therefore be sent to suitable laboratories elsewhere in Europe. Given the time that this may take, early survey arrangements should be made to avoid delays.

For general advice Members and clients should also refer to Gard's compilation "Cargo liquefaction", which contains a collection of articles and circulars published by Gard over the years relating to the carriage of cargoes liable to liquefaction.

We would like to thank Gard's correspondent in Genoa, Italy, Hugo

Trumpy s.r.l., for their assistance in the preparation of this alert.

## Footnote

<sup>1</sup> Zinc concentrate is listed in the IMSBC Code under the schedule for "Mineral Concentrates", which is defined as a Group A product: cargoes which may liquefy if shipped at moisture content in excess of their transportable moisture limit (TML).



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