Dangerous solid cargoes in bulk

DRI, nickel and iron ores

A selection of articles previously published by Gard AS

Contents

Understanding the different direct reduced iron products

Gard News 178,
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The term direct reduced iron, or DRI, has a generic meaning which covers a number of products with a variety of properties and hazards.

There has been a disturbing increase in the number of potential life threatening incidents involving the carriage of direct reduced iron (DRI). Gard Loss Prevention Circular No. 07/2003 provided general advice on the carriage of this product.[1] Since this circular was issued Gard has received several enquiries from members and clients asking about the carriage of this cargo and the actions to be taken to prevent any problems occurring during the voyage.

Disturbingly, some enquiries relate to types of DRI which charterers and shippers do not consider as dangerous or restricted in any way. The terms used include "HBI", "hot briquette", "fines", "remet" and "metallic fines". These terms may well be an accurate description of the specific product but they are often used to avoid limitations agreed in charterparties for the carriage of dangerous cargoes.

It is important to note that the term DRI, generally used in charterparties, has a generic meaning, covering a number of products with a variety of properties and hazards. It also covers a technical description of a specific type of refined iron ore.

These products must be grouped under the genus of direct reduced iron (DRI BC 015 or HBI BC 016) for the purposes of the IMO Code of Safe Practice for Solid Bulk Cargoes (BC Code). This article is intended to help masters and owners understand what may or may not be offered to them and what precautions should be taken.

DRI - Direct reduced iron

Normally in the form of sponge pellets or lumps varying between 6 and 25mm nominal diameter, but often 8 to 12mm diameter. The IMO BC Code classes this product as "a material that is hazardous only when in bulk" (MHB). It can be found under the BC Code as BC015. If this product becomes wet it can significantly overheat and emit hydrogen gas. Thus it must be carried under inert conditions. Nitrogen gas is normally used and is applied to the holds by way of a temporary manifold fitted to the tank top prior to loading. Thermocouples must also be positioned in the cargo on the tank top and elsewhere throughout the stow at different heights to monitor the temperature. Gas monitoring of the holds, normally for hydrogen and oxygen, must also be undertaken throughout the voyage. The product must be kept dry at all times prior to and during carriage. The product should be treated as DRI, BC 015.

HBI - Hot briquetted iron

This material is manufactured from DRI product, which is compressed at temperatures exceeding 650° C to form briquettes between about 90 and 130mm long, 80 to 100mm wide and 20 to 50mm thick. This product is a much safer form of DRI than DRI pellets. It is far more resistant to overheating if it becomes wet. During a voyage it can still generate small amounts of hydrogen. Inerting is not required by the BC Code but adequate surface ventilation is required. It should be treated as HBI BC 016, provided there is no additional qualification to the HBI (see below).

CBI - Cold briquetted iron

CBI is manufactured from the various residual products produced during the manufacture of associated ferrous products and semi-refined raw materials including DRI (DRI fines but also other residuals). Some manufacturers cold briquette their own DRI pellets so that they can be fed into their particular furnace. CBI briquettes are produced at temperatures below 650°C and a binder is often used. Because the briquetting operation is carried out at a temperature lower than is used for HBI, some of the critical characteristics of DRI, such as porosity, relatively large surface area and a reactive surface, remain in the CBI to some degree. Thus essentially CBI can have the same or very similar properties to DRI pellets and should be treated in exactly the same manner, as the propensity to overheat and generate hydrogen, if it becomes wet, still remains. The original source of the material used to manufacture CBI is obviously of significance – if this can not be verified then the CBI should be treated in a similar manner to DRI, BC 015.

DRI fines

These are the by-product of the DRI manufacturing process, pellets or briquettes, and are often 4mm in diameter or less. Although smaller than normal DRI pellets, this product is essentially DRI pellets and will behave in a similar manner, so it should be treated with the same caution: it should be kept dry at all times, the holds should be inerted and temperature and gas monitoring should be carried out. One added potential hazard with this product is that it may not have been stored under ideal dry conditions at the plant, as should be the case with normal DRI, and therefore there may be wet pockets of DRI fines within the cargo, which can subsequently cause problems during the voyage. Therefore, it should be treated as DRI, BC 015 and the storage history should be obtained.

HBI fines

This is a term used by shippers to describe ordinary DRI fines possibly in an attempt to achieve a reduction in the carriage requirements as afforded to real HBI. The fines can be either simple DRI fines which have been completely misdescribed by the shipper, or fines produced during production of HBI. If the fines have been produced after the HBI briquetting process then it is possible that they may be in a relatively safe form and could be treated in a similar manner to HBI briquettes. However, if the fines have been produced prior to the HBI briquetting process, they may potentially be similar to a DRI pellet product. If the history of the fines is not known then they should be considered as DRI fines and treated in the same manner as DRI, BC 015.

Remet fines

This is another term used by shippers to describe DRI fines. They are not "re-melted" fines, as the name could – and may be intended to – suggest, for the obvious reason that if the product had been produced by a (re)melting process (which DRI is not) then it would not be

in the form of fines. If a ship is offered a cargo of this description there is a very high chance of the product being DRI fines and it should therefore be treated as DRI, BC 015.

Remet fines (HBI)
As with 'remet fines', remet fines (HBI) should be treated as DRI, BC 015.

Metallic HBI Fines
As with 'HBI fines', metallic HBI fines should be treated as DRI, BC 015.

Other names
Shippers have used other qualifications for DRI fines which exclude the abbreviation "DRI", such as "Orinoco iron remet fines" and "Orinoco remet fines in bulk". These should all be treated as DRI, BC 015.

Conclusion
It is a requirement of SOLAS Chapters VI and VII and of the IBC Code that the master must be provided with all relevant documentation related to the carriage of the intended cargo. Owners should be wary of any bulk cargo offered for shipment under trade names or abbreviated names and always insist on a full product description, including technical and alternative names. Future versions of the BC Code are likely to maintain the current two categories of DRI but differentiate between the two types by referring to them as DRI "A" or "B".

In summary, if any iron bulk cargo is offered as "fines" and is described with terminology such as "HBI", "remet", or any other wording not found in the relevant section of the BC Code, it should be treated as a DRI product as detailed in the BC Code No. 015. The onus is on the shipper to show that the fines have not originated from DRI manufacture, and without that evidence the ship is entitled to insist on applying the more stringent requirements of BC Code 015 to the loading and carriage.

If the vessel has any doubts about any particular DRI loading it is recommended that independent advice be obtained from an expert. Gard is happy to assist in this regard, and in any other way it can.

This article was produced with the kind assistance of Dave Hughes, Consultant Metallurgist, Taylor Marine TR Little.

Footnote
1 See also the article "The dangers of carrying direct reduced iron (DRI)" in Gard News issue No. 173.

The new IMSBC Code and the carriage of direct reduced iron

Gard News 194, May/July 2009

New code introduces new carriage requirements for direct reduced iron.

The International Maritime Solid Bulk Cargoes Code (IMSBC Code) and amendments to SOLAS chapter VI to make the IMSBC Code mandatory were adopted at the 85th Session of the IMO Maritime Safety Committee at the end of 2008. The amendments are expected to enter into force on 1st January 2011.

The IMSBC Code will replace the Code of Safe Practice for Solid Bulk Cargoes (BC Code).

The IMSBC Code introduces new carriage requirements for direct reduced iron (DRI), which has been divided into the following three sub-categories, based on the increasing hazardous nature of each group:[1]
– DRI (A), made of hot moulded briquettes, is the least dangerous, as the process reduces the reactivity of DRI and the carriage requirements remain essentially the same as the previous BC Code wording.
– DRI (B), made up of lumps, pellets or cold moulded briquettes, is considered to be highly reactive to moisture and the amendments allow carriage only under inert conditions with enhanced monitoring of atmosphere and changes in emergency procedures to reflect current best practices.

For DRI (B), the BC Code already makes carriage compulsory for the entire voyage in an inert atmosphere containing less than five per cent oxygen. The IMSBC Code repeats this requirement, but specifies how this is to be performed. It states that an adequate means of maintaining the inert atmosphere in the hold(s) for the entire duration of the voyage should be provided. An example of this is a vessel fitted with a nitrogen generating plant.
– DRI (C) comprises by-products, such as fines and small particles, which are not dealt with in the BC Code. DRI (C) has very similar properties to DRI (B), but finely divided DRI (C) is considered to be more reactive than DRI (B). This new schedule has been added to reflect the increase in carriage of fines and small particles, which are by-products of the manufacture of DRI (A) and (B). This new schedule closely reflects the increased carriage requirements for DRI (B).

In addition to DRI, the IMSBC Code introduces modified rules to the carriage of coal, brown coal briquettes and formed solid sulphur.

Footnotes
1 See also article "Understanding the different direct reduced iron products" in Gard News issue No. 178.

Carriage of Direct Reduced Iron (DRI) by Sea - Changes to the IMO Code of Safe Practice for Solid Bulk Cargoes

Member Circular
No. 3/2010, 16 March 2010

Members will be aware of the general concerns that exist with regard to the carriage of Direct Reduced Iron (DRI) by sea. These concerns have increased significantly since the loss of life arising from the carriage of DRI on board the YTHAN (2004) and the deliberate sinking by the French Authorities of the ADAMANDAS (2003) with her cargo and bunkers on board.

The explosion and accompanying tragic loss of life on the Ythan resulted from the interaction between the vessel's cargo of "HBI Fines" and the fresh water (moisture) contained in the cargo at the time of loading. At the time of the incident the IMO Code of Safe Practice for Solid Bulk Cargo (the Code) categorised two types of DRI, namely hot moulded briquettes or hot briquetted iron (subsequently re-designated as DRI (A)), and pellets, lumps etc. (subsequently re-designated as DRI (B)). The DRI/HBI fines cargo could not in reality be categorised as either (A) or (B) under the Code and the expert advice was to treat it as the more dangerous and reactive type of DRI (B).

Following the above mentioned incidents and their subsequent investigation, the IMO Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC) considered amendments to the relevant Schedules of the Code as part of a review of the Code. The Marshall Islands, Intercargo and the IG proposed that DRI Fines should be individually classified and designated DRI (C) and both DRI (B) and (C) should be carried under an inert (nitrogen) atmosphere with a maximum allowable moisture content of 0.3 per cent in respect of DRI (C). It was recommended by the DSC at its 12th session held in September 2008 that these (and other minor) amendments be adopted by the IMO through the IMO Maritime Safety Committee (MSC). The MSC adopted the recommendations in November 2008 and the Code was renamed the International Maritime Solid Bulk Cargo Code (IMSBC Code).

The main changes to the Code in relation to the carriage of DRI (A), (B) and (C) can be summarised as follows:

DRI (A), Briquettes, hot-moulded

- a maximum limit on the moisture content of 1 per cent.
- cargo is to comprise essentially whole briquettes. Fines of less than 6.35mm and dust are limited to 5 per cent.
- concentration of hydrogen to be measured throughout the voyage. If it exceeds 25 per cent LEL appropriate precautions to be taken.
- surface ventilation only shall be conducted as necessary. When mechanical ventilation is used, the fans shall be certified as explosion-proof and shall prevent spark generation.
- wire mesh guards shall be fitted over inlet and outlet ventilation openings.

DRI (B), Lumps, pellets, cold-moulded briquettes

- average particle size is limited to 6.35mm to 25mm. Fines of less than 6.35mm and dust are limited to 5 per cent.
- loading conveyors are to be dry.
- prior to loading, an ultrasonic test or another equivalent method with a suitable instrument shall be conducted to ensure weather tightness of the hatch covers and closing arrangements.
- moisture content must be less than 0.3 per cent and must be monitored during loading.
- any cargo that has already been loaded into a cargo space and which subsequently becomes wetted, or in which reactions have started, shall be discharged without delay.
- carriage is only permitted under an inert gas blanket.
- the ship shall be provided with the means of reliably measuring the temperature at several points within the stow, and determining the concentrations of hydrogen and oxygen in the cargo space atmosphere on voyage whilst minimizing the loss of the inert atmosphere.
- the ship shall be provided with the means to ensure that the requirement to maintain the oxygen concentration below 5 per cent can be achieved throughout the voyage. The ship's fixed CO_2 fire-fighting system shall not be used for this purpose. Consideration should therefore be given to providing vessels with the means to top up the cargo spaces with additional supplies of inert gas having regard to the duration of the voyage.
- the ship shall not sail until the master and a competent person are satisfied that:
  - all loaded cargo spaces are correctly sealed and inerted,
  - the cargo temperatures have stabilised at all measuring points and are less than 65°C, and
  - concentration of hydrogen in the free space has stabilised and is less than 0.2 per cent by volume.
- Oxygen concentration shall be maintained at less than 5 per cent throughout duration of voyage.

DRI (C), By-products, Fines

- average particle size is less than 6.35mm, and there are to be no particles greater than 12mm in size.
- the reactivity of this cargo is extremely difficult to assess due to the nature of the material that can be included in the category. A worst-case scenario should therefore be assumed at all times.
- carriage requirements are largely identical to those for DRI (B), including the 0.3 per cent limit on moisture and carriage under an inert gas blanket.

Attached for assistance is a more detailed summary of the carriage requirements for DRI under the IMSBC Code but it should be noted that it is necessary to comply with all of the relevant provisions of the Code.

In light of the above, members, when carrying DRI (B) or (C), should satisfy themselves that the nominated vessel

is capable of maintaining oxygen levels at a concentration of below 5 per cent throughout the voyage.

The Code will remain recommendatory until January 2011 at which point it will become mandatory.

If Members have any questions or concerns relating to the carriage of DRI they should contact their Club.

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 Adrian Hodgson in Gard (UK) Limited (+44 20 7444 7200) or Geir Kjebekk in Gard Arendal (+47 37 01 92 52).

Yours faithfully
Gard AS

Claes Isacson
Chief Executive Officer

All Types of DRI

- Fines are now defined as particles up to 6.35mm (¼") in size.
- Cargo spaces shall be clean, dry and free from salt and residues of previous cargoes. Wooden fixtures and combustible materials shall be removed.
- The carrier's representative is to have reasonable access to stockpiles and loading installations for inspection.
- Prior to loading, the shipper shall provide the Master with a certificate issued by a competent person stating the cargo is suitable for shipment and that it conforms with the requirements of the Code in terms of particle size, moisture content and temperature.
- A similar certificate shall be provided after loading relating to the whole consignment.
- The shipper shall provide comprehensive information on the cargo and safety procedures to be followed in the event of an emergency.
- No cargo shall be loaded or transferred during precipitation and non-working hatches shall be kept closed.
- The cargo shall not be accepted when its temperature is in excess of 65°C, or its moisture content exceeds the permitted value, or if the quantity of fines exceeds the permitted value, where appropriate.
- The cargo temperatures shall be monitored during loading and recorded in a log.
- The cargo shall be trimmed in accordance with the relevant provisions of the Code.
- Adjacent tanks other than double bottom tanks shall be kept empty during the voyage.
- Weather tightness shall be maintained throughout the voyage.
- The bilge wells shall be clean and dry and protected from ingress of cargo.
- Precautions shall be taken to protect personnel, equipment etc. from the dust of the cargo.
- During handling of the cargo, "NO SMOKING" signs shall be posted and no naked lights or other ignition sources permitted.
- Suitable precautions shall be taken before entering cargo spaces, which be depleted of oxygen and/or contain a flammable atmosphere.
- The ship shall be provided with a detector suitable for measuring hydrogen in an oxygen depleted atmosphere and for use in a flammable atmosphere.
- Cargo temperatures and hydrogen concentrations in hold atmospheres shall be measured at regular intervals during the voyage.
- If the hydrogen concentration exceeds 1 per cent or the cargo temperature exceeds 65°C, appropriate safety precautions shall be taken. If in doubt, expert advice shall be sought.
- Bilge wells shall be checked regularly for the presence of water.
- All records of temperature, hydrogen and oxygen measurements, where appropriate, are to be retained on board for 2 years.
- The hydrogen concentration shall be measured in the holds prior to opening the hatch covers.

DRI (A), Briquettes, hot-moulded

- The moisture content shall be less than 1 per cent.
- The cargo shall comprise essentially whole briquettes and the addition of fines shall be prohibited.
- Fines shall comprise no more than 5 per cent by weight.
- Weather deck closures and hatch covers shall be inspected and tested to ensure integrity and weather tightness.
- Surface ventilation only shall be conducted as necessary and air shall not be directed into the body of the cargo. When mechanical ventilation is used, the fans shall be certified as explosion-proof and shall prevent spark generation. Wire mesh guards shall be fitted over inlet and outlet ventilation openings, and the escaping gases shall be unable to enter living quarters.
- During discharge, the application of a fine spray of fresh water is permitted only when the cargo is to be stored in an open area.

DRI (B), Lumps, pellets, cold-moulded briquettes

- The average particle size shall be from 6.35mm to 25mm, with fines no more than 5 per cent by weight.
- The shippers' certificate shall state the date of manufacture for each lot of cargo.
- The certificate issued after loading shall confirm that the moisture content has not exceeded the permitted value.
- The cargo shall be certified as having been aged for at least 3 days, or treated so as to achieve the same reduction in activity.
- The cargo shall be kept dry at all times. Any cargo that has been wetted, or known to have been wetted, shall not be loaded.
- Loading conveyors shall be dry.
- Prior to loading, an ultrasonic test or another equivalent method with a suitable instrument shall be conducted to ensure weather tightness of the hatch covers and closing arrangements.
- The moisture content shall less than 0.3 per cent by weight and shall be monitored during loading.
- Any cargo that has already been loaded into a cargo space and which subsequently becomes wetted, or in which reactions have started, shall be discharged without delay.
- The breakage of briquettes and lumps shall be minimised and the addition of fines shall be prohibited.
- Carriage is only permitted under an inert gas blanket.
- Prior to loading, provision shall be made to introduce a dry inert gas at tank top level. Nitrogen is preferred. All vents and openings shall be sealed to prevent the loss of the inert atmosphere.
- On completion of loading of a cargo space it shall be immediately closed and sufficient inert gas introduced to achieve an oxygen concentration of less than 5 per cent throughout the cargo space.
- The ship shall be provided with the means of reliably measuring the temperatures at several points within the stow, and determining the concentrations of hydrogen and oxygen in the cargo space atmosphere on voyage whilst minimizing the loss of the inert atmosphere.
- The oxygen concentration shall be maintained at less than 5 per cent throughout duration of voyage. The ship shall be provided with the means to ensure that this requirement can be achieved throughout the voyage. Consideration shall be given to topping up with additional supplies of inert gas: the ship's fixed CO_2 fire-fighting system shall not be used for this purpose.
- The ship shall not sail until the master and a competent person recognised by the national administration of the port of loading are satisfied that:
  - All loaded cargo spaces are correctly sealed and inerted;
  - The cargo temperatures have stabilised at all measuring points and are less than 65°C; and
  - The concentration of hydrogen in the free space has stabilised and is less than 0.2 per cent by volume (i.e. 5 per cent LEL).
- The cargo spaces shall remain tightly sealed and the inert condition maintained throughout the voyage.
- The ship shall be provided with a detector suitable for measuring oxygen in a flammable atmosphere.
- Oxygen concentrations shall be measured at regular intervals during the voyage.
- During precipitation, all cargo discharge operations shall be suspended and holds containing cargo shall be closed.

DRI (C), By products, Fines

- The average particle size shall be less than 6.35mm, and there shall be no particles greater than 12mm in size.
- "The reactivity of this cargo is extremely difficult to assess due to the nature of the material that can be included in the category. A worst-case scenario should therefore be assumed at all times."
- The cargo shall be kept within the permissible moisture content at all times.
- The carriage requirements are identical to those for DRI (B), including the 0.3 per cent limit on moisture, with the following exceptions:
  - The shippers' certificate does not need to state the date of manufacture of each lot of cargo;
  - The cargo shall be certified as having been aged for 30 days.
  - Any cargo that has already been loaded and which subsequently is exposed to additional fresh water or seawater over its natural moisture content and becomes wetted, or in which reactions have started and its temperature has exceeded 120°C, shall be discharged without delay.

The dangers of carrying Direct Reduced Iron (DRI)

Loss Prevention Circular No. 07-03

Since the International Group of P&I Clubs' Circular on Direct Reduced Iron published in 1982, the dangers of DRI have somewhat disappeared from the limelight. Gard P&I has recently been involved in several cases, which have served as a stark reminder of the dangers involved in carrying this hazardous bulk cargo.

Types of DRI

DRI is the raw material used in the production of steel in electric arc furnaces, which form the majority of the steel production facilities worldwide. DRI can be split into two distinct sub-groups; cold moulded pellets or hot moulded briquettes. The IMO Bulk Cargo (BC) Code deal with these two types separately. Hot moulded DRI briquettes are a more refined product, formed by the further processing of cold moulded pellets. Both forms of DRI are considered hazardous when carried in bulk and specific carriage requirements are listed in the BC Code.

DRI properties and dangers

DRI in either form is similar to other steel structures in its susceptibility to rust (re-oxidise) in the presence of oxygen. The rate of oxidisation is dependant, to a greater or lesser degree, on the moisture content of the DRI and the atmosphere in which the DRI is carried. The oxidisation process generates heat, which in bulk cargoes of DRI can be significant. The process of oxidation is accelerated in the presence of moisture and is substantially increased if the water contains dissolved chlorides, as is the case with seawater. The sponge-like structure of DRI also inhibits the dissipation of heat and DRI in bulk can therefore heat rapidly in isolated pockets.

Hot iron when in contact with water can cause a chemical reaction resulting in the production of hydrogen, which is highly explosive in the correct quantities. The generation of hydrogen is the most dangerous property of DRI and has led to several fatal explosions. In some manufacturing processes, the DRI undergoes one of two processes called either 'passivation', whereby the briquettes are coated with sodium silicate or 'ageing' in which the briquettes are allowed to form an iron oxide coating. These processes are intended to reduce or inhibit the oxidation process during transit. This additional process is dealt with specifically in the BC Code.

Carriage Requirements

Carriage requirements are set out in the IMO BC Code. Reference should also be made to the latest published advice and carriage requirements approved by the local Competent Authority and issued by the shipper. The BC Code recommends that the shippers should provide specific instructions for the carriage of DRI, and these should either be:

1. That the cargo spaces be maintained in an inert condition, with the atmosphere containing less than 5 per cent oxygen. The hydrogen content of the cargo spaces should be maintained at less than 1 per cent by volume, OR
2. That the DRI is manufactured or treated with an oxidation inhibiting process to the satisfaction of the Competent Authority.

If the atmosphere is inerted, the inerting agent must be nitrogen. Carbon dioxide should not be used, primarily because it can produce carbon monoxide, which is both toxic and flammable. Even on short sea voyages it is recommended that the cargo be fully inerted. Passivation has been shown to effectively reduce oxidation, from fresh water contamination, in the short term, but, over time, the effective protection is reduced. It should be noted that there is little protection from the rapid reactions caused by the ingress of salt water into the cargo spaces. It is therefore recommended that the carriage of DRI should always be undertaken under a nitrogen blanket. The ship's crew should carry out effective monitoring of the atmosphere in the cargo spaces. Records should be kept of the levels of hydrogen and oxygen in each cargo space.

The condition of the cargo should be monitored during loading. Cargo that is hot or damp should not be loaded. It is also recommended that the temperature of the cargo during loading should be monitored. If the cargo temperature is above the ambient temperature, advice should be obtained from the local Competent Authority. However, cargo with a temperature in excess of 65°C should never be loaded. It is usual for temperature thermocouples to be placed within the cargo holds during loading for the monitoring of cargo temperatures during carriage. It is important that these thermocouples are tested prior to being positioned within the cargo and their location within the cargo recorded.

It is also recommended that the cargo should be properly trimmed in order to reduce the amount of surface area exposed to the atmosphere. Trimming also helps reduce the "funnel" effect by reducing the amount of void spaces in the cargo where hot gases can move upwards while drawing in fresh air.

If the vessel has any doubts about any particular DRI loading it is recommended that independent advice be obtained from an expert. The Association is only too happy to assist in this regard, and in any other way it can.

For more information regarding Gard loss prevention products, please contact Terje Paulsen, at phone number +47 55 17 40 85 or email terje.paulsen@gard.no.

Carriage of dangerous cargo - Questions to ask before you say yes

Gard News 197,
February/April 2010

The shipment of dangerous cargo is now commonplace in many trades. This article is aimed at those operating in trades where the carriage of dangerous cargo is not an ordinary occurrence.

Whilst cargoes can be legally dangerous as well as physically dangerous, this article is written in the context of the latter. Unfortunately, there has been a number of cases in which crews and their ships have been lost because of dangerous cargoes (e.g., due to liquefaction) or have suffered harm from fires/explosions caused by dangerous cargoes.[1] The sad truth is that there are some ship operators who probably do not know they are carrying a dangerous cargo because shippers misdeclare them, in some cases deliberately. The commentary below summarises some of the main questions to be asked before agreeing to carry dangerous cargoes, perhaps starting with the most important question: who is shipping? It is in the industry's interest, and particularly the ships' crews', to avoid doing business with so-called "rogue shippers".

Who is shipping?

If the request to ship dangerous cargo (or cargo which, given its description, may be dangerous but not declared as such) is made by a party with whom the carrier has had no previous dealings or experience, investigations ought to be undertaken as to that party's experience in shipping such cargo, and whether they have previously been connected with any accidents or rogue shipments. Of course, rogue shippers can be expected to change names, so be aware of newly-formed companies. If the request or order is from time charterers, it is still important to indentify and research the underlying shipper. In summary: is the party asking to ship/shipping dangerous cargo reliable and trustworthy?
What can you refuse to carry?

Under a time charterparty, the charterer has relative freedom to employ the ship on lawful trades and to load lawful cargoes, but shipowners can exclude their right to load certain cargoes. Therefore, before entering any time charter, particularly a long one, shipowners should think carefully about which dangerous cargoes they wish to exclude. Standard form time charterparties usually contain a cargo exclusion clause, but not all require the shipowners' prior written consent. It is up to the owner to name cargoes he wishes to exclude from carriage and it is worth doing some research (and maybe obtaining expert advice) before doing so. It may be easier to expressly state which cargoes are allowed under the charterparty, to the exclusion of all others without prior written consent. Regulations may require certain fire-fighting arrangements or ships of special construction/strengthening for the carriage of dangerous cargoes and for a document of compliance to be issued before dangerous cargoes can be carried. Also, there may be limitations on the quantity of dangerous cargo that the ship can carry, e.g., for structural/stability reasons and/or because of restrictions under the IMDG Code. On smaller ships, the simple ability to safely segregate certain goods may be an issue.

What are you asked to carry?

It is all too common for dangerous goods to be misdeclared. It also happens that they get incorrectly or incompletely named. Different companies, countries and trades may also use different names for specific dangerous cargoes.[2] It is important to establish the exact cargo you are dealing with by obtaining details on its physical and chemical properties, its hazards and origin. It is then a case of referring to the relevant codes/regulations, such as SOLAS, BC Code and IMDG Code, to establish the relevant carriage guidance. It is important to note, however, that the cargo lists in the IMDG and IMSBC Codes are not exhaustive, which is why details from shippers on cargo properties and hazards are important. Care should be taken to refer to any amendments to the relevant codes/regulations and/or their very latest version (only recently has a new BC Code been introduced - now named the IMSBC Code). Guidance can be sought from the P&I Club or other industry bodies and if necessary advice can be obtained from experts. With reference to the IMSBC Code, it should be noted that a number of specific cargoes may be grouped together under a general entry, e.g., mineral concentrates and metal sulphide concentrates.

What are the dangers/hazards posed by the cargo?

Once the cargo has been correctly identified, the carrier should seek to fully understand the dangers posed by that cargo to the ship and crew. Beyond what is provided in relevant codes/regulations, research can be undertaken with relevant industry bodies, the P&I Club,[3] flag state[4] and port state. It is important to be aware that codes such as the IMDG Code and IMSBC Code may not be completely comprehensive. For example, some ores, fines and concentrates that may liquefy may not be identified as cargoes possessing that hazard in the IMSBC Code. If necessary, expert advice can be sought. The cargo may be dangerous by its very nature (for instance, it poses chemical hazards), but others may only become dangerous in certain circumstances. The carrier should have a basic understanding of how and why the cargo can become dangerous - it may depend on the rate at which it is loaded, its mass/density within a given cargo space, its moisture content, temperature or contact with certain solids/liquids/gases. It is worth remembering that seemingly safe cargoes can create dangerous situations; for example wood can cause oxygen depletion with the obvious risk that poses to those that may seek to enter the cargo space.

What does the ship/crew need to safely carry dangerous cargo?

The ship may need to be of a certain construction or strengthening for the carriage of dangerous cargo. It may also need special equipment, such as fire-fighting apparatus, a nitrogen generator for inerting, temperature monitoring, gas detection devices, protective clothing for the crew. The crew will need to be provided with the relevant codes/regulations containing guidance material on safe carriage and on responding to accidents involving dangerous cargo (e.g., the Medical

First Aid Guide for Use in Accidents Involving Dangerous Goods). Of course, and most importantly, the crew will need to know exactly what dangerous cargo they are carrying (and, indeed, the answers to many of the questions posed in this article - and more).

What should the shippers provide?

The shippers should provide the exact cargo that the carrier has agreed to carry. The cargo actually presented for shipment may well differ from that first declared/notified and the carrier should check this before any cargo is loaded. Obviously, this will be difficult with packaged/containerised cargo, but at least external labels should be checked. Documentation should also match the cargo presented for shipment and that which the carrier has agreed to carry. Full and proper documentation is a key aspect in the carriage of dangerous cargo and, again, no cargo should be loaded in absence of this. Unfortunately, there have been many instances in which shippers have simply failed to provide the required documentation.[5]

Documentary requirements are set out in the relevant regulations/codes and, essentially, form the basis of the information on the dangerous cargo which the carrier needs as evidence that the goods/cargo is safe for carriage, to alert the carrier and his crew to the relevant hazards, and to guide the carrier/his crew on safe carriage and how to react in the case of emergency. The information should be provided sufficiently in advance to enable precautions to be put into effect by the carrier. The shipper's documentation should include analysis certificates for key safety parameters, such as the moisture content, flow moisture point and transportable moisture limit for a bulk cargo that may liquefy. The shipper should provide the relevant declarations that the information provided is accurate. The information provided should be truly representative of the cargo actually loaded. Key safety parameters stated in generic material safety data sheets may not be specific to the cargo to be loaded and should be treated with caution in the absence of analysis certificates that are specific to the cargo to be loaded. Sadly, there have been instances in which shippers' certificates have been found not to be truly representative of the cargo's key safety parameters, which is why it is extremely important for the carrier not to place full reliance on them. If the carrier is in any doubt, he should consider arranging his own tests (see below). In addition to documentation, dangerous cargo in a packaged form should be properly packaged and labelled by the shipper.

What does your contract say?

Cargo exclusions in time charterparties have already been mentioned, but what else does the charterparty say about the carriage of dangerous cargo? Is the master entitled to refuse to load, or, if already loaded, to unload and dispose of dangerous cargo that is unsafe for carriage at charterers' time, risk and expense? If the contract incorporates or will be compulsorily subject to the Hague/Hague-Visby/Hamburg Rules, it should be noted that all these Rules contain provisions with regard to dangerous cargoes. For example, the Hague-Visby Rules provide (in Article IV Rule 6):

"Goods of an inflammable, explosive or dangerous nature to the shipment whereof the carrier, master or agent of the carrier has not consented with knowledge of their nature and character, may at any time before discharge be landed at any place, or destroyed or rendered innocuous by the carrier without compensation and the shipper of such goods shall be liable for all damages and expenses directly or indirectly arising out of or resulting from such shipment. If any such goods shipped with such knowledge and consent shall become a danger to the ship or cargo, they may in like manner be landed at any place, or destroyed or rendered innocuous by the carrier without liability on the part of the carrier except to general average, if any."

The applicable law and jurisdiction under the contract are also worth considering. Will these result in ready access to justice in the event of a dispute or casualty involving dangerous cargo? It should be kept in mind that the law covering liability for loss/damage arising out of the shipment of dangerous goods varies from country to country. Under English common law charterers/shippers would risk being in breach of an implied and absolute undertaking if they were to load cargo without notice of its peculiar characteristics which endanger the ship, unless the owners or their crew knew or ought reasonably to have known of them. In the context of cargo which is known to be dangerous, English case law suggests that owners should be regarded as having contracted to bear risks which can be avoided by appropriate methods of carriage for the goods of the relevant type (the owners being expected to keep up to date with the correct carriage methods but not to have the knowledge of an expert chemist), but not the risks produced by a particular cargo, which are of a totally different kind (whether in nature or degree) from those attached to the carriage of the described cargo, and which should fall on the shippers/charterers. In a recent case[6] the English courts decided that a carrier's right of indemnity against a shipper was not limited to a situation where the dangerous nature was the sole or dominant cause of the loss, but where in any event the damage would not have occurred except for the peculiar characteristics of the actual cargo shipped.[7] The position under English law can be contrasted with that under US law, which appears to be more onerous for the shipowner.[8]

If the Hague/Hague-Visby Rules apply, a claim by the carrier against the shipper under Article IV Rule 6 would, under English law, be defeated if the carrier breached his duty to exercise due diligence to make ship seaworthy and that was a contributing cause of damage resulting from shipment of dangerous cargo. This is very relevant, as shown in the case of the EURASIAN DREAM.[9] In that case the English courts decided that a pure car carrier was rendered unseaworthy as a result of the operators' failure to provide the vessel with specific documentation dealing with the peculiar danger of fire on car carriers and the precautions to be taken to avoid such fires.

The stowage of dangerous goods is often an important factor in their safe carriage and it is worth considering who would be responsible for stowage under the contract. In a recent English court case (involving the negligent stowage of dangerous cargo next to a ship's bunker tanks),[10] it was found that where a charterparty allocated responsibility for the stowage to the charterers, the shipowners had no responsibility to the charterers for damages consequent on improper stowage, even if it rendered the vessel unseaworthy. The outcome of the case would almost certainly have been different had the words "and responsibility" been added to clause 8 of New York Produce Exchange form charter.

It should not be forgotten that, when negotiating contract terms, the shipowner has an opportunity to stipulate what the shippers/charterers are obliged to provide in advance of loading dangerous cargo and what the carrier is entitled to do if the shipper/charterer does not comply. This can be particularly relevant if the place of loading has a history of problem or rogue shipments. Consideration can also be given to making contractual provision for full co-operation from cargo interests, full access to the cargo ashore for possible inspection/sampling and for analysis at specific laboratories which can be relied upon to give accurate results (preferably

being at owner's option to invoke such provisions, whilst not relieving charterers and cargo interests of the primary obligation to provide full and accurate documentation). Such provisions would need to be carefully considered on a case by case basis as the ultimate effect could be to make it more difficult for an owner to refuse to carry a cargo in respect of which doubts still remain.

What is your insurance cover?

It is important to be aware that the carriage of dangerous cargo can, in certain circumstances, prejudice the carrier's insurance cover. There may be a warranty in the insurance contract that no dangerous cargoes will be carried, or that they will only be carried in accordance with relevant regulations. In the absence of any warranty, a general duty of disclosure applies at the inception of an insurance contract (see for example Rule 6 of Gard's Rules for P&I cover). If a vessel's trade in dangerous cargo is not made known to the insurer and the insurer could not be reasonably expected to know of such trade, insurance cover could be prejudiced. Similarly, a radical change in the trade of the ship from one which has, for example, involved the carriage of steel to one involving the carriage of dangerous cargo in bulk could well be deemed to be an alteration of the risk requiring disclosure to the insurer. Rule 7 of Gard's Rules for P&I cover (Alteration of Risk) sets out the consequences of an alteration of risk not disclosed to the Club: one being that the member has no cover for liability, loss, cost or expense caused or increased by the alteration of the risk.

Gard's P&I Rule 74 (Unlawful Trades etc.) provides that:
"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".

The words "unsafe or unduly hazardous trade or voyage" may be of particular relevance in the context of carriage of dangerous cargo, and some guidance may be derived from the legal principles which govern contracts of carriage. Other Club Rules, such as Rule 8 (Classification and Certification of the Ship), requiring compliance with statutory requirements of the ship's flag state, and Rule 73 (Nuclear Perils), which sets out certain exclusions with regard to the carriage of nuclear material, may also be relevant.

Where/when is the carriage to/from?

Another important consideration when asked to carry dangerous cargo is the place/country of shipment. Sadly, a number of countries have a poor reputation for the shipment of dangerous cargoes, probably due to a lack of internal controls and/or sanctions on shippers. P&I Club circulars and articles can be referred to for guidance in this regard. The nature of the voyage and the ship's remoteness from assistance should also be considered. A long voyage through predictably heavy weather may, for example, raise additional concern. Having considered these factors, decisions can be taken on how best to safeguard the crew and the ship.

How to manage the peculiar risks?

If the decision is that the ship can carry dangerous cargo, it is worth spending time considering how the risks peculiar to the dangerous cargo in question can be best managed and minimised. The most important phase is pre-carriage and, as already mentioned, the carrier should put in place his own checks to ensure that the cargo presented for shipment is safe for carriage.[11] Finding out how and where a dangerous bulk cargo susceptible to liquefaction has been stored and for how long is useful to know when moisture content of the cargo is the key safety parameter. Performing the carrier's own tests on the cargo can be as simple as the crew performing a "can test"[12] but if in any doubt proper representative sampling and reliable analysis will need to be considered. It goes without saying that the crew will need to be properly briefed before loading, and all crew members should be aware of the location and dangers of the cargo. It may be necessary to display signs prohibiting entry into spaces containing dangerous cargo and/or properly notify third parties involved in the carriage, such as stevedores and terminal personnel, about the dangerous cargo.

Perhaps most importantly, the crew will need to know the warning signs that something is going wrong with the cargo and how they should respond. If an accident does occur, it will have been prudent to have drilled the crew in the emergency procedures as the speed and thoroughness of the response can often make the difference. The lessons learnt from previous incidents are extremely valuable: they demonstrate the importance of proper risk assessment[13] and quick access to accurate information and expert advice/assistance.[14]

Why should you take the risk?

After reading this article you may ask yourself: "why should I take the risk of carrying dangerous cargo"? No doubt the vast majority of dangerous cargo is carried successfully and without problem. On the occasions when problems do occur, the consequences can be severe. A cautious approach is always to be recommended. As always, prevention is better than cure.

Footnotes

1 See article "Liquefaction of unprocessed mineral ores - Iron ore fines and nickel ore" elsewhere in this issue of Gard News.
2 See for example the article "Understanding the different direct reduced iron products" in Gard News issue No. 178.
3 See Gard's for example Loss Prevention Circular No. 07-03, "The dangers of carrying Direct Reduced Iron (DRI)".
4 See for example the UK MCA Marine Guidance Note MGN 107 (M) in reference to The Merchant Shipping (Carriage of Cargoes) Regulations 1999.
5 See the article "Shipowners stand firm against lack of proper BC Code documentation" in Gard News issue No.193.
6 CSAV v. Sinochem Tianjin Import and Export Corp. (The ACONCAGUA) [2009] EWHC 1880 (Comm).
7 See article "Has justice finally been done in the calcium hypochlorite cases?" in Gard News issue No. 196.
8 See article "The DG HARMONY on appeal" in Gard News issue No. 191.
9 See article "An insight into the interpretation and implementation of the ISM Code" in Gard News issue No. 169.
10 CSAV v. MS ER Hamburg Schiffahrtsgesellschaft mbH & Co KG (The ER HAMBURG) [2006] EWHC 483 (Comm).
11 See for example Loss Prevention Circular No. 15-08 "Loading of hot coal at Maputo, Mozambique".
12 See the article "Shipowners stand firm against lack of proper BC Code documentation" in Gard News issue No.193.
13 See for example the article "P&I incident - dangerous goods container overboard" in Gard News issue No. 179.
14 See for example the article "Facing the challenge of fire at sea" in Gard News issue No. 175.

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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.[1]

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

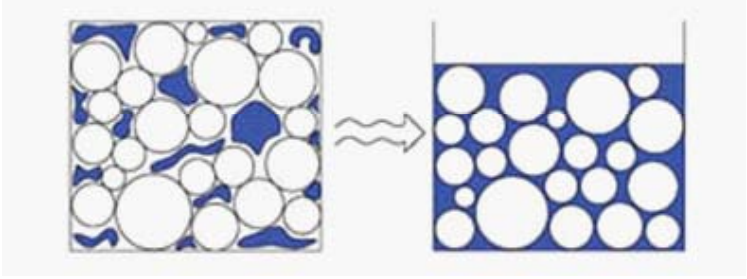

Figure 1: Liquefaction as a result of cargo compaction. In the solid state (left), the shear strength of the cargo is provided by the direct contact between the cargo particles. There are sufficient interstitial spaces to accommodate the inherent moisture and a proportion of interstitial air. As the 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).[2] Cargoes which may liquefy shall only be accepted when the actual moisture content is less than the TML.[3]

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.[4]

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)[5]. 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 whether or not the cargo offered for loading is a cargo that may liquefy.[6] 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.[7] 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.

Flow table test.

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.[8] 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.[9] 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.[10]

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.[11]

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.[12] 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.[13] 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 county may approve additional test procedures.[14] 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.[15] 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.[16] 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.[17] 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.

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 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 lead 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

International Group Member Circular No. 23/2010

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

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.

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