



## CARRIAGE OF NICKEL ORE AND IRON ORE FINES : Detailed Bulletin

1 June 2012

### A. Frequently Asked Questions and Club Cover

#### 1. What are my obligations as an Owner if my vessel is loading a cargo which may liquefy?

Owners must ensure that any charterparty entered into for the carriage of cargoes which may liquefy includes a suitable clause dealing with the carriage of these cargoes. Such a clause must apportion both risk and expense, and must not limit a party's ability to rely on the provisions of the IMSBC Code.

The Master and crew must be made aware of the nature of the cargo to be loaded, and of any issues which may arise. Owners must be aware of the potential inadequacy of cargo documentation, and the Master and crew must also be made aware of this. Owners should also make clear that the Master will have their support should he face any pressure at the loadport to load a cargo without the necessary documentation, or should he find himself in a situation which he feels at all uneasy about. The Master should be made aware of his entitlement (indeed, in some circumstances his obligation) to refuse to load the cargo.

The ISM Code requires potentially hazardous situations to be risk-assessed, and states that vessels must have procedures in place to deal with such situations. It is strongly recommended that Owners whose vessels are likely to carry cargoes which may liquefy put in place procedures to deal with any issues which may arise. These procedures should include:

- (a) carrying out a detailed risk assessment prior to loading the cargo;
- (b) carrying out stability calculations after loading the cargo and prior to departing the loadport;
- (c) the Master making himself aware of any potential ports of refuge on the vessel's planned route, prior to departure from the loadport;
- (d) requiring that as soon as a problem occurs, detailed information regarding the situation is passed from the vessel to Owners, who should then contact the Club who can recommend an expert to provide advice;
- (e) given the dangerous and unpredictable nature of a liquefied cargo, the Club recommends that if a problem arises the Master in any event proceed to the nearest port of refuge.

A detailed risk assessment and having such procedures in place is by no means a guarantee of safe carriage of a cargo which may liquefy. These are measures to have in place in addition to, as opposed to instead of, the steps and requirements set out in the rest of this Bulletin. It must be recognised that even if all required steps are taken (as regards sampling/testing, cargo documentation etc), an issue could still arise whilst the vessel is at sea.

## 2. What are my obligations if I am chartering a vessel loading a cargo which may liquefy?

A vessel and its Master are generally under the orders and directions of Charterers as regards the employment of the vessel. As such, Charterers have a responsibility to ensure that their orders do not put a vessel or the lives of its crew at risk. Charterers must therefore make themselves aware of the effects of liquefaction, the provisions of the IMSBC Code and what is required to comply with those provisions.

Charterers have an absolute obligation to provide a safe and lawful cargo. It is highly likely that the tender of a cargo with a moisture content in excess of its TML would not reasonably fall within any description of a lawful or contractual cargo. Charterers must therefore conduct all surveys/tests required to ensure that the cargo to be carried meets these requirements, or ensure that such surveys/tests are conducted by the relevant party down the supply chain. Alternatively, depending on the provisions of the relevant charterparty, Charterers may be required to indemnify Owners for any costs incurred by them in arranging such surveys and tests.

A regards Club cover, for the carriage of cargoes which may liquefy Members should only charter to or from parties which are entered with an International Group Club for TCL on a strict liability basis. Club cover may be prejudiced in the event that the contractual counterparty is not either insured with an International Group Club, or approved in advance by the Association.

## 3. What are the sampling and testing requirements for a cargo which may liquefy?

For each cargo to be carried, certain figures must be determined. The Flow Moisture Point (“FMP”) is the percentage moisture content at which a flow state commences. From this figure, the Transportable Moisture Limit (“TML”) can be determined. This is 90% of the FMP, and represents the maximum moisture content of the cargo which is considered safe for carriage. The actual moisture content of the cargo must also be determined.

These figures must be determined by testing samples which are fully representative of the particular cargo to be carried. Section 4 of the IMSBC Code sets out a “best practice” sampling procedure.

A cargo’s TML must be determined within the six months prior to loading. A test for the actual moisture content must be carried out within the 7 days prior to loading.

Before the cargo is loaded, the Shipper must provide a certificate setting out both the actual moisture content of the cargo and its TML. These figures must relate to the actual cargo to be loaded. Under the IMSBC Code, cargoes which may liquefy may only be accepted for loading where the actual moisture content of the cargo is lower than its TML.

## 4. What warning signs should the Master look out for when loading a cargo which may liquefy?

The Master should remain vigilant throughout the loading process, and should look out for any signs that the moisture content of the cargo may be higher than stated on the cargo documentation, and indeed may be too high for safe carriage. These signs include:

- is any part of the cargo wet, or does it have a muddy appearance as opposed to a granular, sandy or gravel-like appearance?
- is there any free moisture/water on the surface of the cargo, or running out of the base of the stockpiles ashore?
- does any part of the cargo appear to be contaminated or to have significantly different characteristics or moisture content to the majority of the cargo?

If the answer to any of the above is “yes”, the cargo may well not be safe to carry and further tests will need to be carried out.

Once the cargo is in the holds, it should be checked regularly. Free water above the cargo, a muddy surface appearance, slumping/flattening of party of the cargo in the hold and splashing/quaking of the stow on impact of fresh cargo being loaded are all signs that the water content of the cargo may be too high. In such situations, the Master should arrange for further sampling/testing of the cargo if still at the load port, and should immediately seek the nearest port of refuge if at sea.

#### 5. What should the Master, and I as a Member, do if an issue arises?

If the cargo has not yet been loaded, and the Master is worried about its moisture content, he should refuse to load the cargo. If the cargo has been or is in the process of being loaded, the Master should halt the loading procedure and/or off-load the cargo currently on board. He should keep Owners informed of the situation at all times.

Arrangements should be made for an expert surveyor to attend and for the cargo to be sampled and tested.

#### 6. How should the situation be dealt with if it is raining during loading?

The IMSBC Code specifies that cargoes covered by the entry for Mineral Concentrates (e.g. sinter feed and pellet feed) should not be handled during precipitation unless the actual moisture content of the cargo is sufficiently less than the TML. This will mean that the actual moisture content is not liable to be increased beyond the TML by the precipitation. In practical terms, the effect of this will depend on the rate of rainfall and the margin between the moisture content and the TML.

Many bulk cargoes are stored in open stockpiles between sampling and loading and so are liable to be affected by the weather conditions. A cargo suitable for loading may become hazardous and may liquefy if exposed to precipitation as this will significantly increase the moisture content of the cargo.

The Master should if at all possible halt the loading procedure during any periods of rain. If he is at all worried about the state of the cargo, an expert or surveyor should be appointed and additional analyses of the cargo carried out.

The IMSBC Code specifies that if there has been significant rain or snow between the time the cargo was initially tested and loading, check tests must be carried out. These are to ensure that the moisture content of the cargo is still less than its TML. The interval between such sampling/testing and loading must never be more than 7 days.

#### 7. Which party is responsible for paying for surveys and laboratory analysis?

This will depend on the exact provisions of the charterparty in question. As set out in more detail below, the Club recommends that the clause prepared by the International Group of P&I Clubs be incorporated wherever possible. This provides that Owners are entitled to appoint surveyors and/or experts to test samples of the cargo at their discretion, and that Charterers will indemnify Owners for the costs of this.

In respect of Club cover, the Member bears the costs of surveys and laboratory analysis. If the Member complies with all of its obligations pre-shipment (subject to the Club Rules), they are likely to have the Club’s support in respect of any later disputes.

8. What are the consequences for Club cover of failing to comply with the various Rules and Club requirements/guidelines in relation to hazardous cargoes?

The consequences for Club cover will, of course, largely depend on the specific facts of each situation. However, Members should be aware that Club cover may be prejudiced if:

- (a) the vessel loads a cargo that is found to have a moisture content in excess of its transportable moisture limit; or
- (b) a vessel is lost, and the loading of such a cargo is found to be the likely cause of that loss.

## **B. The Cargoes**

(1) Nickel Ore

Nickel ore is non-homogenous in form, unlike many mineral concentrates, and consists of both very fine clay-like particles and larger, rock-like pieces. There are two different types, limonite and saprolite, which differ in both chemistry and physical appearance. However, they present similar problems in bulk shipping due to their high moisture content.

Nickel ore is mined largely in Indonesia and the Philippines. Very little processing takes place when the ore is mined: it is usually dug up, sorted for size, stored in stockpiles and then shipped. Different mining methods are used in different areas, which can lead to variations in the physical consistency and moisture content of the cargo.

(2) Iron Ore Fines

When iron ore is processed to allow its use in the iron/steel making industry, it is first separated into lumps and fines. Iron ore fines are the less desirable, and lower value, product of this processing. They also have a higher moisture content than the iron ore lumps.

Iron ore fines are often stored in open-air stockpiles, meaning that they are subject to all weather conditions. Any wet weather will therefore cause the moisture content of the fines to increase. For example in India, which is a major producer of iron ore fines, the cargo is often left in these stockpiles during the monsoon season.

It is important not to confuse a cargo of iron ore fines with one of lump ore: the two have very different properties.

(3) Recent Incidents (as at January 2012)

There have been several recent incidents involving vessels carrying cargoes of nickel ore and iron ore fines. The most recent incident involved the “VINALINES QUEEN”, which sank in December 2011 whilst carrying a cargo of nickel ore. The vessel was a total loss, and only one crew member survived the incident.

In late 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 44 lives.

In the 2009 monsoon season, there were at least four separate serious casualties involving vessels loaded with iron ore fines from Indian ports. The “ASIAN FOREST”, “HODASCO 15” and “BLACK ROSE” all sank, with one crew member missing from the latter vessel. The “VINALINES MIGHTY”

listed shortly after sailing, but was able to return to port. It is notable that in the majority of these cases, problems occurred shortly after leaving the port where the cargo was loaded.

It is quite possible that liquefaction was a factor in each of these casualties. The serious nature of these incidents highlights the importance of taking particular care when carrying these cargoes, and indeed any cargoes which have similar properties.

### C. The Main Issue: Liquefaction

The reason why nickel ore and iron ore fines, and similar bulk cargoes, can cause such serious problems during their carriage by sea is because they may liquefy. This is a process by which cargoes may appear to be in a relatively dry granular state when loaded, and yet may contain sufficient moisture to become fluid under the stimulus of compaction and the vibration which occurs during a voyage.

Granular materials, particularly the finely particulate minerals which make up a large proportion of cargoes such as these, may become saturated with moisture. This saturation may mean that the cargo's state changes from solid to liquid under the influence of external forces such as vibration, impaction, or the motion of the vessel. Specifically:

- the volume of spaces between the particles reduces as the cargo is compacted due to settlement, vibration of the ship's engines and the ship's motion;
- this reduction of the spaces between the particles increases the water pressure; and
- the increase in water pressure reduces the friction between particles and causes a reduction in the sheer strength of the cargo.

Liquefaction is likely to seriously affect the stability of the vessel, which in turn can lead to the vessel listing or even capsizing and sinking. When a cargo liquefies, it may flow to one side of the ship with a roll but not completely return with a roll the other way. Consequently, the vessel may progressively reach a dangerous heel and capsize quite suddenly.

As will be clear from the above, the moisture content of the cargo is critical to whether or not it is likely to liquefy. There are certain figures in particular which must be determined in order to determine whether a cargo may liquefy:

- The Flow Moisture Point ("FMP"). This is the percentage moisture content at which a flow state commences. When the moisture content of the cargo reaches this percentage, the cargo may begin to change from a solid state to a liquid one, i.e. it may begin to liquefy.
- The Transportable Moisture Limit ("TML"). This is 90% of the FMP, and represents the maximum moisture content of the cargo which is considered safe for carriage.
- The actual moisture content of the particular cargo to be loaded.

The IMSBC Code requires that cargoes shall only be accepted for loading when the actual moisture content of the cargo is less than its TML.

Cargoes which have an actual moisture content that does not exceed the TML may be loaded in any type of ship. However, cargoes which have a moisture content in excess of the TML may only be carried in specially constructed ships. These must be fitted with permanent structural boundaries to confine any shift of cargo to an acceptable limit. Alternatively, such cargoes may be loaded in ships which are fitted with specially designed portable divisions serving the same purpose. Such ships

require approval by the flag state administration following an application under paragraph 7.3.2 of the IMSBC Code.

The obligation under the Code is on the shipper to determine the TML and the actual moisture content of the cargo prior to loading. These figures must then be declared to the Master prior to the cargo being loaded.

## D. The Regulatory Regimes

There are several regimes which govern the carriage of cargoes, and which will therefore be applicable to the carriage of cargoes which may liquefy. These regimes will be referred to throughout this Bulletin.

### (1) The International Maritime Solid Bulk Cargoes Code (the “IMSBC Code”)

The IMSBC Code is the main reference point for a party when considering whether a cargo is likely to liquefy, and is mandatory under SOLAS. The Code lists the dangers associated with various commonly shipped cargoes, and groups these cargoes by reference to those dangers. Cargoes which may liquefy (i.e. which contain a certain proportion of fine particles and a certain proportion of moisture) are categorised as “Group A” cargoes.

The schedules to the IMSBC Code, in which the specific cargoes are listed, are not exhaustive. Some cargoes which may liquefy are not listed, including iron ore fines. As a result, they are often mistakenly treated in the same way as iron ore for the purposes of the Code. Iron ore, a “Group C” cargo, is not likely to liquefy and so presents far less danger to a vessel on board which it is carried.

It should not be assumed that there is no risk of liquefaction simply because a cargo is not listed in the Code. Both nickel ore and iron ore fines should be treated as “Group A” cargoes for the purposes of the Code, and as such must be carried strictly in accordance with its provisions.

### *The differences between Group A and Group C cargoes under the IMSBC Code*

Cargoes which may liquefy are cargoes which contain a certain proportion of fine particles and a certain amount of moisture. Such cargoes are designated as Group A under the IMSBC Code. Cargoes designated as Group C will not liquefy regardless of the moisture content, and are therefore not hazardous. In order to assess whether a given material may liquefy, Appendix 3 of the IMSBC Code specifies that any damp or wet cargo containing a proportion of fine particles should be tested for flow characteristics prior to loading.

Cargoes can be tested using either the flow table method or the penetration test method, both of which involve increasing the moisture content of a sample until actual liquefaction is observed. For genuine Group C cargoes, this point is never reached and so no transportable moisture limit can be determined. As a result, any cargo which possesses a TML determined by either of these methods is a Group A cargo. However, it should be noted that some materials which are untestable by these tests may still liquefy, and as such are Group A cargoes. Similarly, any cargoes for which actual liquefaction occurs (for example by a flattening of the stow or large-scale cargo flow during ocean carriage) are Group A cargoes, independently of any tests carried out.

On a practical level, Group A cargoes contain sufficient small particles that they can take on a muddy consistency if wet enough. Group C cargoes, by contrast, are gravel-like materials which never become muddy regardless of how wet they are, as any water added drains through the gaps between the particles. Simple qualitative tests to assess this can be carried out on the spot by taking a cargo sample and adding water to it to see if it turns into a mud-like consistency. If yes, the material is likely to be a Group A cargo.

**The IMSBC Code contains far more detail than it is possible to include in this Alert. The Club strongly recommends that all Members who are involved in the carriage of bulk cargoes familiarise themselves with the terms of the Code.**

(2) The International Convention for the Safety of Life at Sea (“SOLAS”)

Chapter VI Regulation 1-2 of SOLAS provides a general framework for the carriage of all cargoes and states that “the carriage of solid bulk cargoes other than grain shall be in compliance with the relevant provisions of the IMSBC Code”. This means that the provisions of the IMSBC Code are now mandatory under SOLAS.

(3) The Code of Safe Practice for the Safe Loading and Unloading of Bulk Carriers (the “BLU Code”)

The BLU Code is referred to in Regulation 7 of Chapter VI, Part B of SOLAS. It is primarily concerned with arrangements between the terminal and the ship in order to ensure safe and efficient cargo operations in port. It was adopted by the IMO by way of Resolution A.862(20), however its provisions are currently only recommendatory.

(4) The International Safety Management Code (the “ISM Code”)

The ISM Code, issued by the IMO, is intended to provide an international standard for the safe management and operation of ships. The ISM Code has been adopted by and incorporated into SOLAS, and as such its provisions are mandatory. One of the key provisions of the ISM Code is that every vessel must have a working Safety Management System.

In relation to the carriage of bulk cargoes, an important provision of the ISM Code is that potentially hazardous situations must be risk assessed, and procedures put in place to deal with such situations.

**E. The obligations of parties involved in the carriage of cargoes which may liquefy**

The carriage of cargoes, and in particular bulk cargoes, is regulated in a number of ways. Where cargoes which may liquefy are concerned, it is important to pay particularly close attention to the provisions of these regulations, and in particular to the provisions of SOLAS and the IMSBC Code.

(1) Owners

Owners’ main concern will be to ensure that no harm comes to their vessel and her crew. It is therefore essential that they ensure that any charterparty entered into for the carriage of cargoes which may liquefy includes a suitable clause dealing with the carriage of these cargoes. For further details on exactly what such a clause should include, see section F below.

Owners should also ensure that the Master and crew of the vessel in question are fully aware of the nature of the cargo to be loaded, and of any issues which may arise. This will enable them to take any action required in a timely manner. Owners must be aware of the potential inadequacy of cargo documentation, and must make the Master and crew aware of this.

Owners should also make clear that the Master will have their support should he face any pressure at the loadport to load a cargo without the necessary documentation, or should he find himself in a situation which he feels at all uneasy about. The Master should be made aware of his entitlement (indeed, in some circumstances his obligation) to refuse to load the cargo.

The ISM Code requires potentially hazardous situations to be risk-assessed, and states that vessels must have procedures in place to deal with such situations. This will logically include the carriage of a cargo which may liquefy. It is strongly recommended that Owners whose vessels are likely to carry cargoes which may liquefy put in place procedures to deal with any issues which may arise while the vessel is at sea. These procedures should include:

- (a) Carrying out a detailed risk assessment prior to loading the cargo.
- (b) Carrying out stability calculations after loading the cargo and prior to departing the loadport. Section 2.1.3.1 of the IMSBC Code states that “the Master shall be able to calculate the stability for the anticipated worse conditions during the voyage, as well as that on departure, and demonstrate that the stability is adequate”.
- (c) The Master making himself aware of any potential ports of refuge on the vessel’s planned route, prior to departure from the loadport.
- (d) As soon as a problem occurs, detailed information regarding the situation should be passed to Owners, who should then contact the Club who can recommend an expert to advise on the best solution.
- (e) Expert advice should be taken as to how best to resolve the problem.
- (f) Given the dangerous and unpredictable nature of a liquefied cargo, the Club recommends that the Master in any event proceed to the nearest port of refuge.

Members should note that a detailed risk assessment and having such procedures in place is by no means a guarantee of safe carriage of a cargo which may liquefy. These are measures to have in place in addition to, as opposed to instead of, the steps set out in the rest of this Alert. It must, however, be recognised that even if all required steps are taken (as regards sampling/testing, cargo documentation etc), an issue could still arise whilst the vessel is at sea. The Master must be in a position to take some practical steps in such a situation.

## (2) The Master

The IMSBC Code, which is mandatory under SOLAS, requires (at paragraph 7.3.1.1) that a cargo which may liquefy shall only be accepted for loading when the actual moisture content of the cargo is less than its TML. The Master must not, therefore, accept a cargo for loading without receiving a certificate setting out the actual moisture content of the cargo, and confirming that this is less than the TML.

It is the Master’s responsibility to ensure that the vessel is safely loaded. Where the required information and cargo declaration have not been received from the Shipper, the Master will be unaware of the properties of the cargo to be loaded. As such, he will not be in a position to know whether the requirements of SOLAS and the IMSBC Code have been complied with. If the necessary declaration is not received, the Master should not commence loading and should immediately inform Owners.

Members should remember that the Master has an overriding authority under SOLAS to delay or cease loading where he has reasonable doubts as to the safety of the cargo. If the Master reasonably believes that the cargo to be loaded is unsafe, he should be given all possible support in resisting any pressure which may be put on him to load the cargo.

The Master or appointed crew members should monitor the entirety of the loading operation in order that they may immediately identify any problems with the cargo. Loading should not however be commenced until the Master is in possession of all requisite cargo information.

Whilst the Master should not unduly question Charterers' orders as regards the employment of the vessel (which will include orders relating to the cargo to be loaded), where such orders endanger the safety of the vessel or her cargo, the Master is not only entitled but may be obliged to refuse Charterers' orders.

(3) Charterers

A vessel and its Master are generally under the orders and directions of Charterers as regards employment of the vessel. As such, Charterers have a responsibility to ensure that their orders do not put a vessel or the lives of its crew at risk. Charterers must therefore make themselves aware of the effects of liquefaction, the provisions of the IMSBC Code and what is required to comply with those provisions. Charterers should not sign, or require to be signed, any charterparty or other document which limits a party's rights to apply the IMSBC Code, or which limits the Shipper's duties as defined in the Code.

Whilst the vessel will generally be under the orders and directions of Charterers, there are some limits to that rule. Commonly used time charter forms for example provide that the vessel is only to be employed in carrying lawful merchandise. A voyage charter will usually specify a contractual description of the cargo, or will refer to a more general description such as "lawful merchandise". What exactly amounts to lawful merchandise will largely depend on the interpretation adopted under the law governing the charterparty. Where a charterparty is governed by an English law and jurisdiction clause, a bulk cargo will only be lawful if:

- (a) The Master has been provided with appropriate information on the cargo sufficiently in advance of loading to enable him to take necessary precautions for its proper stowage and carriage; and
- (b) In the case of any cargo listed as "Group A" under the IMSBC Code, or any other cargo which may liquefy, its moisture content is below its TML (except where the vessel is specially constructed or fitted to carry cargoes with a higher moisture content with the full approval of the relevant Flag state administration).

The prohibition on unlawful cargo is absolute. A Charterer is taken to warrant that the cargo *is* lawful, and *not* that it is lawful to the best of his belief. Where a cargo is specifically described, the cargo loaded must be one which it is reasonable to ask the Master to load and carry. It is highly likely that the tender of a cargo with a moisture content in excess of its TML would not reasonably fall within any description of a contractual cargo.

If an excluded cargo is tendered for loading, Charterers will be in breach of the charterparty. While such a breach will not entitle Owners to terminate the charterparty, it will entitle Owners to bring a damages claim against Charterers.

Where the tender of a specific cargo is rejected, Charterers are entitled to find and tender another cargo (indeed, an invitation to do so may well be Owners' first response to a breach by Charterers). Once Charterers have been put to such election, Owners may well be entitled to terminate the charterparty if:

- (a) It is impossible, or impossible within a reasonable time which would not frustrate the charterparty, for Charterers to tender another cargo; or
- (b) Charterers indicate an unwillingness to tender another cargo.

It is, therefore, essential that Charterers ensure that the cargo to be loaded is a lawful cargo under the relevant charterparty. This is likely to incorporate a duty to survey and analyse the cargo to ensure that the level of moisture content is acceptable.

As regards Club cover, for the carriage of cargoes which may liquefy Members should only charter to or from parties which are entered with an International Group Club for TCL on a strict liability basis. Club cover may be prejudiced in the event that the contractual counterparty is not either insured with an International Group Club, or approved in advance by the Association.

(4) Shippers

Under the IMSBC Code, the Shipper **must** provide either the Master or his appointed representative with “appropriate” information about the cargo. This information must be provided sufficiently in advance of loading to enable the necessary safety precautions to be taken so that “proper stowage and carriage of the cargo” can be carried out. In the case of bulk cargoes, this information must include:

- (a) the Bulk Cargo Shipping Name (“BCSN”) of the cargo. This must be one of the names listed in the index to the IMSBC Code, corresponding to the specific commodity entries in Appendix 1 of the Code. Whilst for many Group A cargoes the BCSN is obvious, some shippers will either provide an incorrect BCSN or omit this information entirely. If none of the names listed in the IMSBC Code correctly describes the cargo, then the shipper must apply to the competent authority of the exporting country, who must issue the Master with a certificate stating the characteristics and required conditions for carriage and handling of the cargo. For Group A cargoes, this certificate must be agreed with the authorities of the vessel’s Flag State and the country of destination. There is currently no applicable BCSN for either nickel ore or iron ore fines;
- (b) the cargo group, as specified in the IMSBC Code, i.e. Group A for cargoes which may liquefy.
- (c) the IMO Class and UN number of the cargo, if applicable;
- (d) the total quantity of cargo offered;
- (e) the stowage factor;
- (f) the need for trimming and the trimming procedures, as necessary;
- (g) the likelihood of shifting, including angle of repose, if applicable;
- (h) A certificate setting out both the actual moisture content of the cargo, and its TML. Under the IMSBC Code, cargoes which may liquefy may only be accepted for loading where the actual moisture content of the cargo is lower than the TML.
- (i) The likelihood of formation of a wet base. Some Group A cargoes are prone to moisture migration during the voyage, i.e. where water drains downwards towards the tanktop and the bilges. These cargoes may develop a dangerous wet base even if the average moisture content of the cargo as a whole is below the TML. This can lead to undetected liquefaction, even if the cargo surface appears to be dry. This is key information, and yet few shippers are currently providing it, despite it being an express requirement of the IMSBC Code. In order to minimise this risk of undetected liquefaction as far as is possible, it is suggested that the Master request that the cargo be trimmed flat (for more details, see section E below).

The BLU Code sets out a recommended form for cargo information at Appendix 5. Information provided by the Shipper must be accompanied by a declaration. An example form for this declaration is at section 4.2.3 of the IMSBC Code.

This information must be provided prior to the cargo being loaded.

In the case of cargoes which may liquefy, a certificate must also be supplied which certifies both the actual moisture content and TML of the cargo. The TML is derived from the FMP, which can only be determined by laboratory analysis. Unless the FMP has been determined by a reputable laboratory, it is likely that any documentation tendered by the Shipper will be unreliable. The interval between testing the FMP and loading must be no more than 6 months, and the interval between testing the actual moisture content and loading must be no more than 7 days. The IMSBC code requires a new test “where the composition or characteristics of the cargo are variable for any reason”. Cargoes such as nickel ore and iron ore fines are inherently variable, and as such require a new TML test for each cargo.

The Shipper must be required to identify the laboratory where the cargo samples were tested. The number of laboratories which are able to carry out suitable tests on these sorts of cargoes is currently very limited. For further details and recommendations on laboratories, see section F below. The Shipper must also be asked to identify the stock piles from which the cargo is to be loaded. He should confirm, in writing, that the samples tested and in respect of which certificates have been issued or declarations made originated from these particular stock piles. All such samples must be tested prior to loading.

The information provided must be in relation to the actual cargo to be loaded. Some shippers have been known to offer moisture certificates which are based on an average of previous cargoes, rather than the cargo actually offered for loading. This does not comply with the IMSBC Code sampling requirements.

#### *Shippers' liability*

The effects of liquefaction are likely to mean that cargoes which may liquefy satisfy the definition of “dangerous” cargoes. Under Article IV Rule 6 of the Hague-Visby Rules, the Shipper of dangerous cargo is absolutely liable where the Master or carrier has not consented to the shipment of the cargo in question. Further, the Shipper is liable for “all damages and expenses directly or indirectly arising or resulting from such shipment”.

### **F. Specific Issues and Guidance**

#### **(1) Sampling and testing of cargo**

As set out above, before a cargo which may liquefy can be loaded, the TML and the actual moisture content of the cargo in question must be determined and certified prior to loading. This means that any sampling and testing must also take place prior to loading. The IMSBC Code states that both TML and moisture tests are meaningless unless they are conducted prior to loading on truly representative samples.

Shippers sometimes state that their stockpiling arrangements make it impractical to take representative samples prior to loading, and instead propose that samples be drawn during the loading process itself. This is common practice for sampling for the purposes of the contractual quality specifications. However, such proposals are not compatible with the shipper's certification obligations under the IMSBC Code (see section E(4) above).

There have been many instances where information provided by the shipper has stated that the cargo has been within the TML, but has later proven to be a cargo which may liquefy. This could be due to poor testing procedures, or a lack of understanding on the part of the Shipper of the sampling and testing procedures required, despite the detailed advice on the conduct of such tests provided in the IMSBC Code.

#### *Sampling the cargo*

The IMSBC Code states that a test to determine the TML shall be conducted within six months prior to the date of loading. Where the composition or characteristics of the cargo are variable for any reason, a further test must be carried out after it is reasonably assumed that such variation has taken place (paragraph 4.5.1 of the IMSBC Code).

For actual moisture content determination, samples must be tested **as near as practicable** to the time of loading and in any event within a seven day period prior to loading. If thereafter there is significant rain (or snow) between the time of testing and loading, "check tests" must be conducted to ensure that the actual moisture content remains less than the TML. These check tests are quick tests, for example the "can test" or using a properly calibrated rapid moisture meter, which will give an idea as to whether the moisture content of the cargo is too high. If there is any indication of such, the actual moisture content must be tested again and the FMP and TML may need to be tested again. Should the check tests show any signs that the moisture content is too high, the Club requires that an expert be appointed, if this has not already been done.

Prior to sampling, the cargo should be inspected and any substantial portions which appear to be different from the bulk of the consignment (e.g. parts which are visibly wetter or muddy) should be sampled and tested separately. Portions that on separate testing are found to have a moisture content above the TML should be rejected as unfit for loading, even if the average moisture content of the entire consignment is below the TML.

Sampling methods must be carefully adapted to the manner in which the cargo is stored or handled, and to the physical properties of the cargo. The overriding requirement in the IMSBC Code is that the samples to be tested must be truly representative of the cargo to be loaded. In particular the Code emphasises that sampling methods must take into account any variations in moisture distribution throughout the consignment. These variations could occur, for example, because of natural drainage which may result in the lower levels of a stockpile being wetter than the surface.

#### *Procedure for Sampling Concentrate Stockpiles*

The IMSBC Code provides guidance on sampling frequency for concentrate stockpiles of cargo. It is emphasised that what is referred to in the IMSBC Code is guidance, designed to assist and inform. It is not mandatory because, as the Code states, it is not practicable to specify a single method of sampling for all consignments. However, the procedures set out in the Code are to be taken as best practice. All samples tested must be fully representative. Simply taking samples from the surface of a stockpile, for example, will not satisfy this requirement. Whilst it may be inconvenient to take the required representative samples, this is not a reason to cut corners. If the sample tested is not fully representative, the cargo documentation will be inaccurate and lives will be put at risk.

Following the IMSBC Code's suggested procedure, a plan of the stockpile is drawn and divided into areas, each of which contains approximately 125t, 250t or 500t, depending on the amount to be shipped. Such a plan will indicate the number of sub-samples required and where each is to be taken. Each sub-sample taken is drawn from approximately 50cm below the surface of the designated area.

For consignments between 15,000MT and 60,000MT, at least one sub-sample is drawn for each 250MT to be loaded. This rises to one sub-sample for each 500MT for consignments above 60,000MT. This is the minimum requirement. The Code envisages that all sub-samples are composited to form a final analysis sample. However, if there are concerns that a stockpile may be non-homogenous, an expert may recommend separate analysis of multiple samples, or even analysis of every sub-sample.

Cargoes such as nickel ore and iron ore fines are less homogenous than concentrate cargoes, and given the properties of a particular cargo it may be appropriate to take more frequent samples. Where sub-

samples are taken from a stockpile, they should be drawn evenly from all parts of the stockpile including the interior. This will require the use of mechanical equipment, and cannot be done by hand.

For cargoes whose composition or characteristics are variable for any reason, the IMSBC Code requires separate TML testing for every single cargo to be shipped. This will include many Group A cargoes, including nickel ore and iron ore fines. The most practical approach is to carry out both the TML and moisture determination on the same set of samples, drawn as set out above.

#### *Methods of testing*

Appendix 2 of the IMSBC Code sets out three recommended test methods for determination of the TML. The most common method of testing is the “flow table test” which, whilst straightforward for some materials, is not so for these sorts of cargoes. Materials such as nickel ore and iron ore fines are more complex than the homogenous mineral concentrates for which the flow table test was developed, and testing must be carried out by experienced analysts. For example, the IMSBC Code specifies that the flow table method is only suitable for materials with a maximum particle size of 7mm. Many iron ore fines cargoes, and essentially all cargoes of nickel ore, exceed this size. While a certain percentage of particles over 7mm in size can be tolerated, the flow table method often requires adaptation which is not covered in the Code to deal with these cargoes.

The two other testing methods (the penetration test and the Proctor/Fagerberg test) are encountered very rarely. There have been some moves recently to use one or the other of these methods due to the perceived shortcomings in the flow table test method. The penetration test has the potential to be the most useful test, and there are no known technical issues. However there are very few setups in operation for this test and so it is unknown whether such issues will surface in the future. The Proctor/Fagerberg method involves first oven-drying the sample, and then adding water to determine the bulk density at a number of different moisture contents. The test method is therefore unsuitable for materials that change properties on drying and subsequent re-wetting, for example materials with a significant clay content. This includes all nickel ore cargoes and many cargoes of iron ore fines.

#### *Recommended laboratories*

The IMSBC Code requires that samples be tested in a competent laboratory. There are very few reputable, independent laboratories which deal with the testing and sampling of cargoes. Shippers often insist that their own laboratories be used for testing and sampling, which can lead to questionable results. Many laboratories are not equipped, and do not have sufficiently experienced staff, to properly test cargoes such as nickel ore and iron ore fines. As for suitable laboratories please contact The Swedish Club Loss Prevention department ([lossprevention@swedishclub.com](mailto:lossprevention@swedishclub.com)) for recommendations.

## (2) Cargo documentation

One of the reasons for the provision of inadequate cargo documentation may be due to a lack of understanding on the part of the shipper and/or its representatives of the potential dangers posed to the vessel by spurious figures. If the figures provided on the cargo documentation are incorrect, and no additional investigations are carried out, the Master could leave the loadport believing that the cargo is safe to carry, when in fact it has a higher than recommended moisture content and may well liquefy whilst the vessel is at sea.

There may be situations where the shipper’s cargo declaration is not presented before loading, where the required moisture information is not included with the declaration, or where the documentation presented does not reflect the characteristics of the cargo actually presented for loading.

The inaccurate information could also be due to the fact that the state of the cargo has changed since it was tested, for example if it has been affected by heavy rains. The IMSBC Code requires a shipper to retest the cargo in such circumstances, but many shippers fail to do this.

The Master may come under considerable pressure to load a cargo without first receiving the required cargo documentation. This pressure should be resisted if at all possible, and Owners should support the Master in such resistance. It is far better to delay loading whilst awaiting accurate documentation than to have to discharge cargo which is subsequently found to be unsuitable, or indeed to put the vessel at risk.

Before loading commences, the Master must ensure that he receives, in writing from the Shippers, the required certificates stating both the TML and actual moisture content of the cargo. Certificates which simply state that tests have been carried out to the correct standard and have been “passed” should be rejected. Further, any local rules or requirements to have the cargo sampled and satisfactorily analysed as a condition for obtaining port clearance are not a substitute for the Shipper’s obligation to present the necessary certificates. See Section E(4) above for full details of the information that must be provided by the Shipper.

The certificates provided should be carefully scrutinised to check for completeness and any inconsistencies or signs that cast doubt on their authenticity. The Shipper or its agent should be asked questions about the sampling procedures, so that the source of the samples is properly identified. Even where a certificate states that a cargo is safe to load, the Master and crew must be vigilant in monitoring the condition of the cargo as it is loaded. Different stockpiles of cargo have different characteristics, and all involved in the loading operation should not assume that the properties of the cargo loaded will match the cargo documentation precisely.

Where a cargo declaration has not been received, or where either the TML or actual moisture content are not included in the certification, the Master should refuse to load the vessel and should immediately contact Owners or the local Club correspondents for advice.

The Club has concerns about the accuracy of cargo documentation presented by some Shippers, as many laboratories do not have the experience or facilities to conduct the analyses required for that documentation to be accurate. The Club therefore requires independent analysis of the cargo to be carried out at a suitable laboratory. If cargo documentation is provided which does not meet with recommendations contained in this bulletin and/or International Group circulars, Members should, if necessary make their own arrangements for analysis. If in exceptional circumstances this is not possible, Members should speak to the Club for guidance as to what steps to take.

### (3) Steps to take to minimise the risk of loading an unsafe cargo

As set out above, it is essential that all members of a vessel’s crew involved in cargo operations, and in particular the Master, understand the characteristics of the cargo to be loaded. The Shipper’s cargo declaration cannot always be relied on to be accurate. As a result, it is essential that the Master and crew remain vigilant throughout the loading process. Failure to identify a cargo which may liquefy may lead to serious problems for the vessel. It is, however, acknowledged that this is not an easy task: cargo which has an unacceptable TML may still appear to be dry.

During loading, the Master and crew should look out for any signs that the moisture content of the cargo may be higher than stated on the cargo documentation, and indeed higher than is safe for the vessel to carry. These signs include:

- (a) is any part of the cargo wet, or does it have a muddy appearance as opposed to a granular, sandy or gravel-like appearance?

- (b) is there any free moisture/water on the surface of the cargo, or running out of the base of the stockpiles ashore?
- (c) does any part of the cargo appear to be contaminated or to have significantly different characteristics or moisture content to the majority of the cargo?

If the answer to any of the above is “yes”, the cargo may well not be safe to carry and further tests will need to be carried out. Once the cargo is in the holds, it should still be checked regularly. Free water above the cargo, a muddy surface appearance, slumping/flattening of part of the cargo in the hold and splashing/quaking of the stow on impact of fresh cargo being loaded are all signs that the water content of the cargo may be too high. In such a situation, the Master should arrange for further sampling/testing of the cargo if still at the load port, and should immediately seek the nearest port of refuge if at sea.

It is suggested that the “can test”, as detailed in paragraph 8.4 of the IMSBC Code be used to check the state of the cargo at frequent intervals during loading, and in particular if the Master is at all worried about the moisture content of the cargo. A small can is filled with a sample of the cargo, and is repeatedly banged against a hard surface. The appearance of the sample following this will give an indication of whether or not the cargo is suitable for shipment. If the sample shows any free moisture on the surface, or has become fluid (i.e. if the sample has flattened into a mud-like surface appearance rather than a granular sandy or gravel-like appearance), then the moisture content of the cargo may well be too high, i.e. above the FMP.

This test is *not* a substitute for proper laboratory testing and should never replace a reliable TML and moisture content declaration from the Shippers. Further, it cannot detect whether or not the moisture content of the cargo is also below the TML. However, if the results indicate that the cargo may liquefy, then this should be taken as a major warning sign that the cargo may be unsafe. Expert advice should then be sought and arrangements made for additional tests to be conducted on a representative sample.

Where a Shipper presents a significant amount of cargo which fails the “can test”, this indicates that the cargo as a whole may be unsafe, and that any documentation which states to the contrary may be flawed. It should also be borne in mind that just because no free moisture is seen in the sample following the “can test”, this does not mean that the cargo is definitely safe for shipment.

As set out in section E(4) above, a cargo which appears dry on the surface can still form a dangerous wet base and liquefy. This risk can be minimised by trimming the cargo flat over the entire width of the cargo space to the longitudinal boundaries of the holds on completion of loading and prior to sailing. The height difference between the peaks and troughs of the cargo should not exceed 5% of the ship’s breadth. The IMSBC Code states that the Master has the right to require the cargo to be trimmed level, and it is recommended that the Master insist on flat trimming for all Group A cargoes. Indeed, trimming is a mandatory requirement for cargoes covered by the entry for Mineral Concentrates in the IMSBC Code (which includes cargoes such as sinter feed and pellet feed). Members should note, however, that this is not a complete solution and trimmed cargoes can still liquefy.

It is sometimes suggested that pumping off any free water from the surface of the cargo will minimise the risk of cargo shift. This is not the case: free water is a symptom of liquefaction, not its cause. Pumping off free water will still leave the cargo in a flow state and liable to shift unpredictably. Further, it should not be assumed that the absence of free water means that the cargo has not, or will not, liquefy. Undetected liquefaction may take place inside the cargo even if the surface appears dry.

In the event of any problems arising over the properties of a particular cargo, it is strongly recommended that Members engage an independent surveyor or expert to assist. At some ports, it may

in fact be a local requirement to appoint such a person. Members should contact the Club for advice as to who to appoint. Where a surveyor is appointed, it should be made clear to the port authorities, Shippers and Charterers that the appointment of a surveyor is not intended to, and indeed does not, relieve any party of its obligations under any relevant codes or local regulations.

The IMSBC Code contains some specific recommendations to aid the stability of the vessel when loading bulk cargoes at section 2.1.3.

(4) Local and commercial pressures

Terminal representatives may put commercial pressure on Masters to load their vessels before receiving the necessary cargo declarations. There may also be commercial pressures placed on the Master by Shippers and/or Charterers to sail before the cargo has been sampled and tested. Due to the limited number of laboratories available to carry out the required analysis, it can sometimes take a long time for the results of the tests to be received. In situations where vessels are fixed for short voyages, there may be a strong commercial motivation for the vessel to sail immediately after samples have been taken rather than risk delay in waiting for the test results.

Masters are urged to resist such pressures. It is a Master's responsibility to ensure that the vessel is safely loaded. Where the cargo declaration has not been received, the Master has no idea of the likely properties of the cargo to be loaded.

(5) Discharging unsafe cargo

If cargo is loaded prior to the receipt of the required documentation, it may be necessary to discharge the cargo if it is subsequently found to be unsuitable. Such discharge may be problematic due to a lack of suitable equipment or berths, or due to local customs procedures or other regulations. Terminals and/or shippers may simply be unwilling to accept the discharged cargo.

A loaded cargo may well be regarded as having been exported by the relevant customs and excise authority. As a result, unloading could create bureaucratic difficulties. Further, there may be commercial reluctance on the part of shippers and/or ports to accept or unload unsuitable cargo. This could lead to unwanted cost and delay. Should a dispute arise, valuable commercial relationships may also be damaged.

If the cargo can be discharged, it may be possible to allow it to dry out ashore. However, this can take months and requires the cargo to be regularly moved and turned over.

The question of whether or not a cargo is safe to transport should therefore be determined before the cargo is loaded.

(6) Sailing with an unsafe cargo

It may be the case that, despite all precautions being taken and all necessary steps being followed, cargo which is unsafe for transport is loaded and carried. Members must be aware, however, that carrying such a cargo is contrary to both SOLAS and the IMSBC Code unless the vessel in question is specially constructed or fitted. Where a vessel is not specially constructed or equipped for the carriage of cargoes with a moisture content in excess of its TML, there is no SOLAS-compliant way to carry such a cargo. If liquefaction takes place at sea, both the vessel and its crew may be in real danger.

Detailed stability calculations should be carried out for every cargo loaded prior to departure from the load port. The results of these calculations should immediately be made available to any expert whose assistance is requested following an incident of liquefaction.

In the past, where difficulties have arisen in persuading shippers or loadport authorities to discharge unsafe cargo, various suggestions have been made as to steps which can be taken to minimise the risk of liquefaction. These include sailing with reduced speed, staying close to land, and avoiding heavy weather. While such measures may reduce the amount of movement to which the cargo is subjected, they are not supported in SOLAS. There is no guarantee of their effectiveness and it is not possible to quantify the risk in any meaningful way, as vessels have been known to sink suddenly in calm conditions as a result of liquefaction of the cargo. Members should not, therefore use such measures as a substitute for taking all required steps to ensure that the cargo is safe for transport.

Another suggestion which is sometimes made is to restrain the cargo surface by strapping or by placing bagged cargo on top. Whilst this can prevent shifts in grain cargo, it cannot prevent shifts in a cargo which may liquefy. Liquefaction happens throughout the depth of the stow and even if the surface is restrained, cargo can flow in the depth of the stow independently of surface restraints.

Initial signs of liquefaction may include unusual rolling behaviour, sudden jolts or changes in trim. However, there may be no warning signs at all and it should not be assumed that any large scale cargo shift will be preceded by such alarm signals. Some vessels have experienced severe problems as a result of liquefaction without first reporting anything amiss.

If liquefaction does occur, the Master must immediately notify Owners, who should then seek the advice of an expert. In any event, if a cargo has liquefied it is both dangerous and unstable. The Master should therefore immediately proceed to the nearest suitable port of refuge.

#### **G. Charterparty Clauses**

If it is anticipated that bulk cargoes which may liquefy will be carried, it is essential that a suitable clause is incorporated into the relevant charterparty. Such a clause will need to provide for the sampling, testing and certification of the cargo and deal with which party will bear the cost of both those procedures and of any delays arising as a result of any issues with the cargo.

In the Club's experience, Charterers may try to have Owners accept a clause which limits the obligations of Charterers and Shippers to the extent that dangerous cargo may be loaded on board the vessel. The following is an example of an inappropriate/insufficient clause:

*"Cargo to be loaded, stowed, trimmed and discharged in accordance with latest IMO/IMDG Code regulations and recommendations. For nickel ore, shippers and/or charterers shall provide the customary documents only including the cargo declaration certificate showing the cargo moisture content lower than the transportable moisture limit ("TML"). Once cargoes have been loaded on board, the cargo which is already on board should be treated to have been accepted as safe cargoes by Owners and should not be further sampled/tested. If the Master feels the cargo moisture content is higher than the transportable moisture limit ("TML"), Owners are allowed to appoint one of the surveyors from the 2 companies below. The cargoes are to be tested through the method of can test only. Surveyors' costs/expenses are to be for Owners' account. If the cargo fails the can test inspection, the Master has the right to refuse to load the cargo and to require the Shipper to substitute a suitable dry cargo, in this case the surveyors' costs, expenses and time wasted are to be for Charterers' account."*

This clause raises several issues.

- (a) It attempts to limit the cargo documentation which the Shippers and/or Charterers must provide. This will mean that the Master and Owners are unlikely to be fully aware of the true state of the cargo prior to loading.

- (b) It provides that once the cargo is loaded, all cargo on board shall be deemed to have been accepted and shall not be sampled or tested further. This does not make any provision for the fact that the state of the cargo may well change during loading or that the cargo documentation may not accurately reflect the actual state of the cargo.
- (c) It limits the surveyors which can be appointed by Owners to those which Charterers deem to be suitable. As has been stated above, it is essential that any analysis of the cargo is carried out by an experienced, competent laboratory. Owners must therefore be able to appoint a surveyor/laboratory who will carry out any analysis thoroughly and accurately.
- (d) It provides that, if the Master has any worries about the state of the cargo, the cargo can only be tested by way of the “can test”. As set out above, while the can test can be indicative of the state of the cargo, it should never be used as a substitute for proper testing. A cargo may well satisfy the can test, but still be liable to liquefy once the vessel sails.

The International Group of P&I Clubs has produced a standard clause, as follows:

*Solid bulk cargoes are to be presented for carriage, loaded, (and where necessary trimmed) only so far as lawful and harmless, and always in compliance with all applicable international regulations, including IMSBC Code 2009 (as may be amended from time to time). All time taken in complying with such regulations, or as a result of non-compliance shall be for Charterer's sole time and expense (whether as hire or as laytime/demurrage as applicable). Charterers shall be responsible for any and all additional costs, expenses and liabilities whatsoever incurred in such compliance or as a result of any non-compliance. The Charterers are to provide certificate(s) of test from a laboratory which must be approved in advance by Owners at Owners' absolute discretion, and such certificate(s) of test must show the TML (transportable moisture limit) and FMP (flow moisture point) and moisture content. Such certificate(s) are to be presented to Owners and Master prior to, and as a condition, of the commencement of loading. The Master shall also have the right in his absolute discretion to refuse to accept cargo on board or, after loading, to refuse to sail, where in his reasonable opinion, there is a risk (including but not limited to the risk of liquefaction of the cargo) which could jeopardise the safety of the vessel on the voyage. The Master shall also have the right in his absolute discretion to demand that such cargo be offloaded from the vessel. Such refusal and/or demand to offload shall not be a breach of charter and Charterers shall be responsible at their sole time and expense (whether as hire or as laytime/demurrage as applicable) for all steps required to make the cargo safe and/or to allow the vessel to sail to the satisfaction of the Master. In any event, Charterers are to allow Owners or their representatives to take samples of cargoes prior to, and as a condition, of loading and Owners shall be entitled to test such samples and/or appoint surveyors and/or experts to act on their behalf always at Owner's discretion. Charterers agree to pay and indemnify Owners for all costs and consequences incurred as a result of Charterers' orders to load solid bulk cargoes and all the time taken up by the steps outlined in this clause shall be for Charterers' account and Charterers shall be responsible at their sole time and expense (whether as hire or as laytime/demurrage as applicable). This clause is always without prejudice to the obligations of Charterers to provide a safe cargo and in relation to loading and nothing done or omitted to be done by the Master or Owners pursuant to this clause shall amount to a waiver of any rights of Owners.*

Whilst this clause is drafted very much in favour of Owners, in the Club's view the incorporation of this clause will go a long way to minimising the risk of carrying certain bulk cargoes and preventing casualties. As such, the Club recommends that this clause be incorporated into all relevant charterparties wherever possible.

BIMCO is currently preparing a standard clause dealing with the carriage of such cargoes. The Club will provide an update on this clause once it has been published.

*Disclaimer: This Member Alert is intended to provide only general guidance and information pertaining to the issues identified and commented upon herein. The content of this Alert is not intended to be, and should not be treated as being final and binding legal advice. If Members consider they are likely to or in fact have encountered problems or difficulties as discussed in this Alert, they are asked to contact the Club and obtain further legal advice relevant to their specific circumstances.*