

Carriage of Nickel Ore

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Introduction

Have you ever turned a bottle of ketchup upside down only to find nothing comes out, put the lid on, shaken the bottle and then swamped your plate with sauce? If so, you have experienced liquefaction.

However, what you do not want to experience is cargo liquefaction. The consequences for your ship can be:

- delays at the load port from rejecting cargo or problems with certification of cargo already loaded
- stability problems on voyage from loss of metacentric height (GM) due to free-surface effect, cargo shift or wet base leading to a list, angle of loll or capsizing
- delays at the discharge port or port of refuge making the ship safe and discharging a cargo in a fluid state.

The definitions, tests and precautions in the International Maritime Solid Bulk Cargoes (IMSBC) Code for cargoes that may liquefy are widely associated only with metal ore concentrates, for which their application is relatively straightforward. But any cargo with fine particles and moisture could potentially liquefy and should be queried with the shipper.

Unprocessed nickel ore from various remote islands in Indonesia and the Philippines is one such cargo. If the moisture content of the ore is too high then it can liquefy just like concentrates and display the same liquid behaviour. Serious problems have been experienced with ocean transport of these cargoes including the foundering of several vessels with serious loss of life.

The IMSBC Code requirements apply to nickel ore but the test methods within the code do not always give well-defined results. Several laboratories have obtained widely differing results on samples supposedly representing the same cargo. This allied to the remoteness of many mines and lack of expertise of some shippers laboratories makes the carriage of nickel ore problematic.



Disclaimer

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Unless the contrary is indicated, all articles are written with reference to English Law. However it should be noted that the content of this publication does not constitute legal advice and should not be construed as such. Members should contact the Association for specific advice on particular matters.

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This briefing describes in more detail the problems associated with liquefaction of nickel ore, and the difficulty in determining its moisture content and flow moisture point, information that is critical when deciding if it is safe to carry.

The Association is very grateful to Ken Grant of Minton, Treharne & Davies (MTD) and Nicholas Crouch and Martin Jonas of Brookes Bell for providing articles in North of England's Signals newsletter on which this briefing is based.

Liquefaction

In its solid state the particles of the material are held together by friction and the cargo has the characteristic of a solid. Cargo on loading appears 'normal' – like slightly damp sand (see Figure 1). However, if there is sufficient moisture in the cargo, external agitation can increase the pore water pressure to the 'flow moisture point' (FMP), where water pushes the particles apart. The material then undergoes a sudden transition to the flow state where it loses the friction between particles. The cargo begins to behave like a liquid (see Figure 2).



Figure 1 - Solid state – before a 'can' test – particles held together by friction



Figure 2 - Liquid state – after a 'can' test - no friction between particles

The 'flow moisture point' (FMP) of any cargo that may liquefy is absolutely critical – even the slightest excess of moisture above the FMP could lead to liquefaction.

International Maritime Solid Bulk Cargoes (IMSBC) Code

Cargoes that may liquefy will contain moisture and at least a proportion of small particles. This includes a wide range of mineral cargoes other than concentrates, with widely differing physical and chemical properties. The IMSBC Code certification requirements apply to all cargoes which may liquefy regardless of whether or not the cargo is specifically identified as posing a liquefaction risk. Never assume there is no risk of liquefaction simply because a cargo is not identified as 'Group A' in the IMSBC Code. A schedule for Nickel ore which describes it as a Group A cargo was included from the 2013 edition of the IMSBC Code.

Transportable Moisture Limit (TML)

Sections 4, 7 and 8 of the IMSBC Code deal with assessment of acceptability of consignments for safe shipment and production of test certificates showing the 'transportable moisture limit' (TML) and actual moisture content of cargoes. Any ship operator contemplating carrying fine-grained mineral cargoes should carefully read these sections of the IMSBC Code.

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During a voyage the cargo can be agitated by wave impact and engine vibration and, if there is sufficient moisture present, the cargo may reach FMP and liquefy.

This may result in loss of GM from free-surface effect, sudden cargo shifts and structural impact damage from sloshing.

For this reason the master must be completely satisfied that testing has been carried out strictly according to the procedures set out in Appendix 2 of the IMSBC Code.

Because of the severe consequences of exceeding the FMP, the safety margin provided by the lower TML is critical and should not be compromised.

For the Flow Table Test and Penetration Test the TML is defined as 90% of the FMP. The TML of a cargo determined using the Proctor/Fagerberg test is taken as equal to the critical moisture content at 70% degree of saturation. It is a requirement of the International Convention for the Safety of Life at Sea (SOLAS) that the average moisture content of any type of granular cargo in any cargo space must not be higher than the TML.

The difference between the TML and the FMP is intended as a safety margin to protect against uncertainties in testing – such as laboratory errors, sampling errors and variations in moisture content in the cargo. Shippers must certify the TML and the moisture content of the cargo before start of loading. No cargo should be accepted for loading without valid certificates. If the actual moisture content at any location in the cargo is greater than the FMP then the cargo can liquefy at any time without warning.

There are no 'safe' weather conditions or routings for carrying a cargo above its TML. If masters have doubts about the testing procedure and appearance of the cargo then they should conduct a 'can' test as described in the IMSBC Code section 8.4.

Nickel Ore

The high price of minerals recently has made some trading viable which would otherwise be uneconomic. One such trade is the shipment of unprocessed nickel ore from various remote islands in Indonesia and the Philippines on long ocean voyages. These ores have relatively low nickel content and have been shipped on shorter voyages to Australia and Japan for many years.

As with many fine particulate minerals, including mineral ore concentrates, these ores have the propensity to liquefy if their inherent moisture level is too high. There have been

several serious instances of cargo liquefaction of nickel ore, including total losses and near-misses.



Background

Nickel laterite is an inhomogeneous low-grade ore consisting of very fine clay-like particles and larger rock-like particles. There are two different types, limonite and saprolite, which differ in their chemistry and their physical appearance, but present similar problems in bulk shipping due to their high moisture content.

The nickel ore in question is simply dug out of the ground, sorted for size, stored in stockpiles and then shipped. Apart from the drying effect of the sun – which is of unquantifiable benefit – there is no further processing involved.

Because of the way the ore is mined the composition and physical behaviour can differ greatly from mine to mine, from shipment to shipment, from the same mine, and even within a single cargo.

Assessing Whether Cargo is Safe

As described earlier, assessing whether a cargo is safe to ship requires the transportable moisture limit (TML) to be calculated. The TML is then compared to the moisture content of the cargo, and provided the TML is the higher figure, the cargo should be safe to load.

There are problems with both the determination of TML (which for nickel ore needs to be determined by a competent laboratory separately for every single cargo) and moisture content (which must be of the cargo offered for

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shipment), which the IMSBC Code requires shippers to provide prior to commencement of loading.

The ore is not found in a homogeneous form. Much of the material is very fine clay-like particles but there are also larger rock-like particles, some of which can be very large indeed.

The FMP testing methods in the IMSBC Code have been developed with concentrates in mind and rely on uniform physical and chemical properties throughout the cargo. For cargoes that consist of a wider range of particle sizes – from rocks through pebbles to sand or soil-like material – the IMSBC Code tests become less reliable. It may not always be possible to certify the FMP of these types of cargo using the test procedures in the Code. It may also be difficult to find qualified laboratories that are willing to certify the FMP of materials other than concentrates.

Sampling of Nickel Ore

Various problems arise with sampling for moisture content and FMP/TML testing. Some stem from the actual manner in which the stockpiles are physically sampled. In a recent case, it was found that the mine did not routinely sample the stockpiles prior to shipment, but rather sampling was conducted during the course of loading. As this was too late to comply with the requirements of the IMSBC Code, their practice was to present the master with information relating to the cargo loaded onto a previous unrelated vessel.

In turn, the results of the analysis of the cargo loaded onboard the subject vessel would then be presented to the next ship and so on. By the time the subject consignment had actually been characterised in terms of its suitability for carriage, it had already been loaded, making it more difficult to resolve any issues arising. The master would have been totally unaware of the fact that he was carrying a potentially dangerous cargo.

The shippers in this case (which is not exceptional in our experience) were in breach of the requirements of the IMSBC Code for a number of reasons. Firstly, the moisture content data on the cargo certificates related to a different cargo and not the actual one due to be carried. Secondly, the stockpiles intended for loading onboard the subject vessel had not been sampled in accordance with the requirements of Section 4 of the IMSBC Code. This details the frequency and extent of sampling for a given stockpile size, and states that sampling should be conducted no more than one week prior to shipment if the ore is stored uncovered – as most nickel laterite stockpiles are. Should

there be significant rainfall between the time of testing and loading a suitable further test to determine the moisture content of the cargo shall be conducted by shippers to ensure that the material is still in a safe state to load.

Moisture Content Determination

The in-homogeneity of lateritic nickel ore means that the proportion of the fine clay-like and larger stone-like fractions in different samples can vary significantly. As the clay material typically has higher moisture content (30 – 50%) compared to the larger stony fraction (about 20%), the actual moisture content determined will be an average. As a consequence, the actual moisture content of the clay-like fraction, which is the one prone to liquefaction, will typically be higher than the declared value.

Preparation of samples for moisture content and FMP determination using the Flow Table Test can be a lengthy process involving samples being spread out on a floor in hot environments. One can therefore expect moisture loss due to evaporation and contact with a dry surface. Although this is not critical for FMP determination (providing testing is carried out correctly), it will result in an underestimation of moisture contained in the actual cargo to be loaded, from which there will be no such moisture loss.

Flow Moisture Point Testing

Appendix 2 of the IMSBC Code provides three methods for determining the FMP of commodities. One of these methods, the Flow Table Test (FTT), is the method of choice of the nickel ore mines. However, the FTT was developed for measuring the FMP of relatively homogeneous mineral concentrates. The IMSBC Code states that the method is primarily for materials with grain sizes up to 1mm, but “may also be applicable to materials with a maximum grain size up to 7mm”. The IMSBC Code also warns that the method may “not give satisfactory results for some materials with high clay content”. Lateritic nickel ore is inhomogeneous, comprising a mixture of fine and larger particles (> 7mm), and has a high clay content. This does not preclude the application of the method to nickel ore, but it does mean that great care is required in performing the test.

The FTT method involves preparing a sample on a flow table in the form of a truncated cone. The flow table top is then raised and allowed to fall sharply through a defined vertical distance. This simple procedure is repeated up to 50 times and the behaviour of the sample cone observed to see if “plastic deformation” has occurred. The construction of the flow table and the test methodology is described in great detail in the IMSBC Code. However, it is the experience of

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the authors that neither the set-up or test method described is being adhered to by the nickel ore mines, with the potential for inaccurate FMP and TML information being declared to the vessel. Some preliminary experiments carried out by MTD (Singapore) on limonite ore, and information gathered by both MTD and Brookes Bell on site, support these concerns.

Before we can address these issues, we first need to discuss another area of debate, the identification of plastic deformation.

Identification of a Flow State

The IMSBC Code does not provide any definite criteria for identifying a flow state (Appendix 2, Section 1.1.4.2.3), but instead lists a number of physical observations that indicate plastic deformation, and suggests procedures for measuring this deformation. The physical signs include: "moulded sides of the sample may deform"; "cracks may develop on the top surface" of the sample cone; "the sample cone begins to show a tendency to stick to the mould"; and there may be "tracks of moisture on the table" following the test. As regards measuring the extent of deformation, "an increase in diameter of up to 3mm in any part of the cone is a useful guide". An alternative approach is to measure the increase in diameter (if any) following additions of water to the sample. If in the first instance there is 1 – 5mm increase, followed by 5 – 10mm increase, a flow state is indicated.

While some of the Philippine mines rely solely on identifying a subjective change in shape of the sample cone, the Indonesian mines tend to rely only on measuring the extent of the deformation (typically 3mm). These vastly different approaches can lead to a great variance in the declared FMP. No consideration is given to the overall behaviour of the sample, and the key indicators referred to in the IMSBC Code may simply be ignored.

Construction of the Flow Table

According to the IMSBC Code the metal frame of the flow table is to be attached to a metal base plate, which in turn is securely fixed to a concrete plinth that is isolated from the floor by cork matting. This arrangement is designed to provide a known constant force to the sample during testing.

Typically, the mines do not comply with the IMSBC Code, and frequently utilize a free standing table on various surfaces. Figure 1 shows the FMP determination at a Philippine mine for a limonite ore when the table was (a)

loosely fixed to a wooden desk, and (b) when securely fixed to a concrete plinth.

A much smaller deformation was obtained with the flow table mounted on a flimsy wooden desk, due to dissipation of energy into the structure of the support, compared to the deformation observed with a similar sample when the flow table was securely fixed to a rigid platform. This would result in a higher FMP being declared for an incorrectly fixed table.

Figure 1. Effect of Table Fixing on FMP

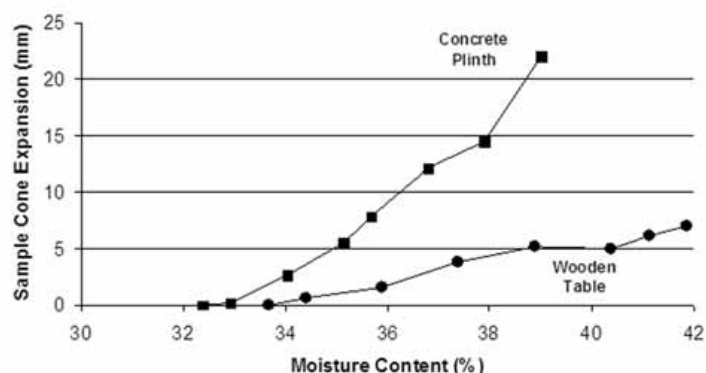
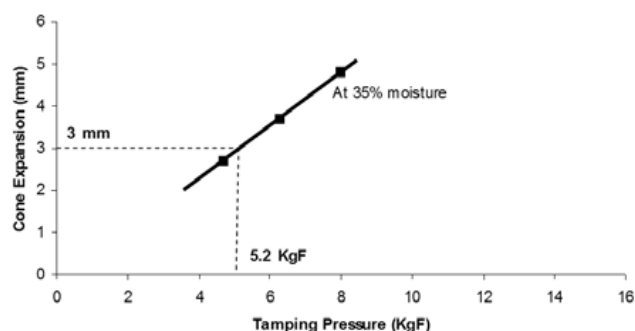


Figure 2. Effect of Tamping Pressure on Cone Expansion



Effect of Tamping Pressure

Before the FMP of nickel ore can be determined it needs to be prepared in the form of a truncated sample. The sample mould is filled in three distinct phases, each layer being compacted by a defined number of actions with a tamper. This is to simulate the packing of the material in the cargo hold. The tamping pressure used is calculated from the bulk density of the cargo (at loaded moisture content) and maximum depth of the cargo in the hold. In the case of nickel ore such tamping pressures can be difficult to apply, and as a consequence, the mines apply incorrect technique and reduced tamping pressure. In effect, the sample is simply spread around to fill the mould, rather than compacted.

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Figure 2 shows the significance of this failure, where cone expansion on the flow table is plotted against tamping pressure for a limonite sample in the MTD Laboratory.

The sample contained 35% moisture. Using the 3mm cone expansion used by a number of the mines as indicating a flow state, this sample would only fail the FTT if a tamping pressure >5.2KgF had been applied. This tamping pressure would correspond to a cargo depth of only 3 - 4m. In reality, the depth of cargo would be greater, requiring a correspondingly greater tamping pressure. By using a lower tamping pressure you are underestimating the FMP. You can effectively control whether a sample passes or fails the test.

Determining Moisture Content at Flow Point

The FMP is determined by adding water to a stock sample of nickel ore until a flow state is determined. At the mines there is no control of the laboratories' environment, and moisture loss can be expected.

The IMSBC Code is specific in requiring that "the whole moulded sample should be placed in a container, weighed immediately and retained for moisture determination". This is not done at many of the mines. Instead, they start with a known weight of sample that is fully utilized in the sample mould, and use the declared moisture content of the cargo as the baseline moisture content. If the sample passes the FTT the whole of the sample is removed and water added, with the test being repeated. The new moisture content is then calculated based on the original sample weight and the volume of water added. We have witnessed both moisture and sample loss during this procedure. The failure to determine the moisture content of the samples experimentally will result in an overestimation of the moisture content, and consequently, FMP.

Advice to Shipowners

In all recent instances that we are aware of, shippers of nickel ore have issued certificates based on sampling and testing carried out by the respective mine's in-house laboratory.

Regrettably, extensive audits of the sampling and testing methods used by these mines have in every instance so far revealed serious deficiencies, which have rendered the values certified by shippers effectively meaningless.

This presents shipowners with a serious dilemma. They are faced with a choice of either accepting the values certified by shippers at face value, despite the high probability of these certificates being flawed, or of becoming actively involved in an (inevitably acrimonious and time-consuming) investigation of the safety of the cargo being offered for shipment.

Nickel Ore Circular

In response to the situation with shipments of nickel ore the Club has issued a circular reminding ship owners of their obligations to comply with the IMSBC Code when carrying such cargoes. A copy of the circular is appended below.

Responsibility of Crew

It is imperative for the safe operation of the vessel that officers involved in cargo operations understand the characteristics of the cargo to be loaded. Owners and managers have a responsibility to ensure that prior to presenting the vessel for loading the master is fully informed of the characteristics of the intended cargo. This will enable him to take action in a timely manner, especially if concerns require the appointment of a cargo specialist, many load ports are isolated and the appointment and arrival of a cargo specialist can be time consuming.

Accuracy of Information Provided

Cargo documentation provided for this cargo is often inadequate and does not alert the crew to the potential risk of liquefaction. There are many examples of insufficient information being presented by shippers to the master and a few cases of documentation for cargo loaded on an entirely different vessel being handed over. Ore cargo characteristics and moisture content in particular can change during seasonal climate variations, shippers have a responsibility to ensure cargo information provided is recent, relevant and accurately determined. For nickel ore cargoes that may liquefy this must include the moisture content and the transportable moisture limit (TML).

The composition of some nickel ore cargoes can often be of an inhomogeneous nature. Testing methods for cargoes that are prone to liquefy described in Appendix 2 of the IMSBC Code were designed to assess the suitability of ore cargoes with a maximum granular size of 7mm and are described as not necessarily giving satisfactory results for material with a high clay content. Nickel ore and lateritic nickel ore in particular have both. Testing can still be carried out, however the process and results often give values of

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moisture content below the actual value of the intended cargo. Values of TML and moisture content should therefore be treated with caution.

Shipowners should be aware that in recent cases in the Philippines, we have come across certificates similar to those encountered during our first involvements with nickel laterite ores being shipped from Indonesia. These certificates state simply that the material has been tested in accordance with the IMSBC Code Flow Table Test method and found to pass. No figures for the FMP and TML are stated although average moisture content, which is valueless without a TML, is provided. Needless to say, it is not possible to assess the safety and suitability for carriage of a material based on such an incomplete declaration.

Inspection of Cargo Prior to Shipment

This can be very difficult for the master if cargo is being transhipped by barge as is usually the case. If the cargo is stored in uncovered stockpiles and has standing water, moisture content may be high, especially during the wet season. If possible a comparison of appearance between stockpiles and cargo loaded on barges should be conducted to determine if they are from the same stockpile.

The IMSBC Code describes a shipboard method (the “can test”) for checking whether a cargo may be suitable for shipment. This involves filling a small can with the material and repeatedly banging it on a hard surface. The appearance of the material at the end of the test can be used to form an opinion about the suitability of the material for shipment. This test should not be a substitute for proper laboratory testing using an appropriate methodology.

However, if can tests carried out on a cargo presented for loading indicate a propensity for liquefaction, this is a major warning sign that the cargo as a whole is unsafe for carriage.



Expert advice should then be sought. If shippers present significant amounts of ore that fails the can test, this is an indication that the cargo as a whole is unsafe, and that any certification to the contrary is flawed.

During loading nickel ore cargoes with high moisture content can often be detected by the way the cargo splatters and liquefies when it enters the hold, evidence of free water in the hold would reinforce the masters suspicion.

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APPENDIX

Indonesia and the Philippines - Safe Carriage of Nickel Ore Cargoes

CIRCULAR REF: 2011/009

CIRCULATED TO ALL MEMBERS, BROKERS AND DIRECTORS

Introduction

The carriage of wet lateritic nickel ore can present very serious risks to the safety of a ship and its crew. These risks arise out of the inherent properties of the cargo, the lack of proper testing facilities at the port of loading; on occasion intimidation of surveyors representing the ship's interests and the widespread disregard by shippers of their obligations under the IMSBC Code.

In practical terms this can mean that it is very difficult to reach a firm conclusion as to whether a cargo of nickel ore is safe to carry.

Shipowners who intend to carry nickel ore are reminded of their obligations to comply with the IMSBC Code when carrying such cargoes. Members are referred to Club Circular 2010/037 dated 7 December 2010 "Mandatory Application of the International Maritime Solid Bulk Cargoes Code (IMSBC Code)" the contents of which are deemed to be incorporated into this circular.

Members intending to carry nickel ore are also referred to the Association's Loss Prevention Briefing "Carriage of Nickel Ore" which may be viewed on the Association's website.

Recent Casualties

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.

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. 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.

- 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.
- 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.
- 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.
- 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.

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- Nickel laterite has a 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.
- 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.
- 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 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.
- 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

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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

- 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.
- 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:

- To assist the Master with compliance with his obligations under the Code and local regulations (when not in conflict with the Code).
- 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.
- To take owners' own representative samples for testing in an independent competent laboratory which is likely to be located outside the country.
- To liaise with an independent expert to ensure that the laboratory conducts its tests in accordance with Appendix 2 of the Code.
- 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.
- 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.
- 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).
- 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.

- To ensure loading is suspended during periods of rain.
- 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.
- 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.
- 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.
- 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.
- 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. Members are reminded that if they fail to comply with the Code or local regulations when not in conflict with the Code, they are likely to prejudice their Club cover pursuant to Rules 26 and / or 29. 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 and / or where a Member has failed to comply with Classification and Statutory requirements.

Carriage of Nickel Ore

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

MJC SALTHOUSE

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As Managers on behalf of the North of England P&I Association
Limited