



Mineral Cargoes: “Red Flags” when loading certain clay cargoes

In light of ongoing vessel casualties recently and over the last few years, this bulletin is intended to highlight some important “red flag” issues with respect to cargoes like ball clay and what the shippers, vessel charterers, owners and indeed the crew can achieve to load a cargo safely. If all involved parties are invested and proactive in obtaining the necessary information prior to loading, this makes loading unsafe cargo considerably more difficult and therefore should prevent expensive delays and potential serious casualty.

What is a group A cargo?

Some mineral cargoes have the propensity to liquefy when being transported. The IMSBC Code (“the Code”) describes this in section 7.11 and 7.12:

7.1.1 The purpose of this section is to bring to the attention of masters and others with responsibilities for the loading and carriage of bulk cargoes, the risks associated with liquefaction and the precautions to minimize the risk. Such 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.

7.1.2 A ship's motion may cause a cargo to shift sufficiently to capsize the vessel. Cargo shift can be divided into two types, namely, sliding failure or liquefaction consequence. Trimming the cargo in accordance with section 5 can prevent sliding failure.

Cargoes that are liable to liquefy are listed as Group A (or A and B) in the Code. However, over the years there has been a great deal of confusion with respect to how to deal with certain mineral cargoes that appear to be classed as Group C but can behave like a Group A cargo.

For example, FLUORSPAR was classed as Group B in previous versions of the Code¹. As a response to numerous vessel casualties, in the latest editions it is now classed as A and B.

¹ In even earlier versions of the Code, when different classification terminology was used, it was acknowledged that some types of FLUORSPAR could liquefy.

The Code is not fully explicit on types of cargo that are listed but have hazards beyond those listed in the Code. It is a reasonable argument that any cargoes that are not covered by the existing schedule at all should be considered a totally different and therefore unlisted cargo, which can only be shipped with a Section 1.3 certificate². This is the approach IMO have taken with BAUXITE and IRON ORE – the Group A “versions” of those have a different BCSN and a different schedule.

An alternative consideration might be a Section 1.5 “*Exemptions and equivalent measures*” certificate, but that section specifically refers to provisions that are “at least as effective and safe as that required by the Code. This therefore would assist with cargoes that are less hazardous than the Code indicates rather than more hazardous.

CLAY

There are still some mineral cargoes that are classed as group C in the Code, yet certain varieties nonetheless show flow properties, or have been implicated in marine casualties. CLAY is one such commodity – it is classed as Group C and the only notable precaution is as follows:

The moisture content of this cargo shall be kept as low as practicable to prevent the cargo becoming glutinous and handling of the cargo becoming extremely difficult.

Nevertheless, certain types of clay have been shown to have liquefied resulting in vessel casualty, loss and regrettably loss of life. Samples of the clay loaded on the vessel have exhibited measurable flow properties when tested according to the Code methods for Group A cargoes.



Flow table test on ball clay– before and after

² This requires IMO competent authority engagement at least of the port of loading and, if assessed to have significant hazards, the input of flag state and unloading port state competent authorities. Either way, a certificate is provided to the master by the load port competent authority, and this is also submitted to the IMO for potential incorporation into the Code.



Penetration test on mill scale– before and after

There is guidance in the Code for these occurrences in Appendix 3, section 2:

2 Cargoes which may liquefy

2.1 Many fine-particled cargoes, if possessing a sufficiently high moisture content, are liable to flow. Thus any damp or wet cargo containing a proportion of fine particles should be tested for flow characteristics prior to loading.

One such cargo is described as “ball clay” and while shippers were declaring it as Group C, some have heeded the Code guidance, conducted flow tests on the material, found it to flow and therefore have begun shipping it as a Group A cargo. This is another example of types of cargo that are listed but have hazards beyond those listed in the Code, as mentioned earlier.

The details of cargo sampling and testing is beyond the scope of this bulletin, but the Code provides detailed guidance on how cargo should be sampled and tested, including the critical procedures for sampling such as how and when to take the sample, how to package and look after it, and how to test it. The relevant test results to understand for this bulletin are:

- **Flow Moisture Point (FMP)** – defined in the Code as “*the percentage moisture content (wet mass basis) at which a flow state develops under the prescribed method of test in a representative sample of the material*” The Transportable Moisture Limit (TML) is calculated from this (TML is 90% of FMP).
- **Moisture content (MC)** – the mass of water in a sample, expressed as a percentage of the total wet mass (i.e. moisture mass ÷ (dry mass of cargo + moisture mass) × 100).

The following sections are what we consider the “red flags” when loading Group A cargoes in general and are particularly applicable to clay cargoes, where there is more uncertainty in the cargo nature.



CARGO INFORMATION

Section 4.2.2 of the Code mandates a written list of cargo information, which should all be obtained – where relevant - well in advance of loading (as per section 4.2.1). This includes specific critical data such as the hazard group. Section 4.2.3 specifies the provision of a cargo declaration form.

If the intended cargo is a CLAY declared as Group C, we would advise requesting written documentation confirming whether tests have been conducted as per the Code Appendix 3, section 2 as previously quoted above. We would advise not to accept the cargo until this fundamental information is provided.



TML (Transportable Moisture Limit) Certificate

This is mandatory for group A cargoes. As highlighted in the Code section 4.3.2, it must:

- Be signed
- Be issued by an entity (usually a public laboratory) recognised by the local IMO competent authority
- Contain or be accompanied by the result of the test used for determining TML³. This is important because the original FMP measurement for flow testing can also be checked.

TML certificates can be valid up to six months depending on the variability of the commodity (section 4.5.1).



MC (Moisture Content) Certificate

Also highlighted in section 4.3.2, this is mandatory for group A cargoes. It must:

- Be signed
- Be issued by an entity (usually a public laboratory) recognised by the local IMO competent authority
- Contain or be accompanied by a statement by the shipper that “*the moisture content is to the best of his knowledge and belief, the average moisture of the cargo at the time the declaration*” is presented to the master.
- Be below the TML. If MC is greater than TML, the cargo should not be loaded (also noted in section 7.3.1.1).

MC certificates are only valid for 7 days from sampling (section 4.5.2). If the certificate shows a date that exceeds this duration, the cargo should not be loaded. If precipitation

³ It is not relevant for clay cargoes, but some Group A cargoes can have a TML measured directly by testing, rather than measuring FMP and then calculating TML from FMP.

occurs between sampling loading, the shipper must provide evidence to the master that the MC has not reached TML – this might constitute resampling of the cargo or evidence of stockpile covering.

The reason there is a short gap between sampling and loading is because the moisture content can change from a variety of sources. Some clay minerals can absorb humidity, for example.



Shipper's Procedures Approval

Section 4.3.3 of the Code requires shippers' procedures (i.e., "*for sampling, testing and controlling moisture content to ensure the moisture content is less than the TML when it is on board the ship*") to be approved and their implementation checked by the competent authority of the port of loading.

A document must be provided to the master issued by the local competent authority stating that the shipper's procedures have been approved.

Having their procedures approved by the competent authority means that the shippers have established reasonable methods of cargo control including all aspects of sampling and testing. In our direct experience, many Group A cargo shippers worldwide are still unaware of their responsibilities in this regard.

We would recommend not loading cargo if this document is not readily available – it should be well before the vessel arrives. If not available, loading the cargo in accordance with the Code is usually insurmountable because of the – understandably - long time taken for competent authority to approve a shipper.



Stockpile of nickel ore about to be sampled

Can tests

Section 8.4 of the Code allows the master/crew to test cargo using an “auxiliary method”. Section 8.4.1 gives the procedure. If “free moisture” or a “fluid condition” is observed then the Code recommends (“should”) arrangements to be made to have additional laboratory tests conducted.

We recommend can tests are conducted regularly prior to loading if possible and regularly throughout loading. In addition to the Code’s recommendations, we recommend that for each can test, time and date-stamped photographs should be taken of the surface of the material in the can before and after the test is conducted.



Can test conducted on ball clay, before the procedure on the left and after on the right – this is a clear failure with a fluid condition attained during the test.

Even if the clay cargo is declared as Group C, we recommend this is conducted.

The use of the can test must be viewed in the context that it is an auxiliary test. Its usage assumes that the cargo being presented for loading has already been sampled and tested according to the requirements of the Code and thus failed can tests (apart from a trivial quantity of cargo) indicate a deeper issue with the procedures, hence further investigation and/or testing should be performed. If can tests fail, then we advise stopping loading and conducting a review that the salient requirements of sampling and testing are all in place. This can save a great deal of time and money later and the information required should be freely and readily available from shippers if their procedures are appropriate as per section 4.3.3.

Recently, can tests are being used as a stop/go system for loading, with surveyors rejecting barges or trucks that fail, but accepting and loading ones that pass. We consider this an inappropriate use of the test and not what the Code intends.

Finally, it is critical the correct size and type of can is used. We have seen large paint cans used, which deform and are too large and unwieldy for one hand (as directed by the Code). Some surveyors have used plastic bottles, which are clearly inappropriate.

Oven tests

Also recently, owners have been directing crew to conduct “oven tests” by drying samples of the cargo in the galley oven and weighing on kitchen scales. Owing to the inaccuracy of the equipment, we would strongly advise this is not conducted. It can easily underestimate the moisture content of a cargo and give a false sense of safety.

Observations

Evidence gathering when loading Group A cargoes is invaluable and one useful source is the cargo behaviour during loading. Often, if dropped from a height when loading, cargo

that looked dry one ashore might begin displaying flow characteristics. The cargo might look fluid and leave splatter marks. Taking regular photographs or even better, short 10 second videos of the loading procedures can be very helpful. If any such behaviour is observed, we advise loading should be stopped and can tests conducted before any further cargo is loaded.



“Splatter” on bulkhead – Bauxite cargo

Concluding remarks

Despite most of the above recommendations being established IMSBC Code stipulations, many parties involved may be unaware of them; or aware and resistant to providing the information for a variety of reasons.

Most of the information and documentation should be available well before the vessel arrives and should be resolutely pursued from the shippers well in advance of arrival. MC analysis is slightly different in that the Code stipulates a maximum of seven days between sampling and loading and, given the time required for analysis, the result is normally not available until close to loading.

There should be no reason for delays due to provision of this important information and, if there are any significant delays, we would recommend extreme caution in proceeding with loading.

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