UK P&I CLUB

L P Bulletin

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# Bulletin 1017 - 01/15 - Bauxite Loadings - S America/Asia

**Members will be aware of the recent loss of the bulk carrier BULK JUPITER with an apparent tragic loss of life. That ship had reportedly loaded a cargo of Bauxite at Kuantan in Malaysia. Whilst it is too early to make conclusions there are understandably concerns that the cargo may have played a part in the loss of the ship, particularly as it has been reported that the cargo was loaded after a period of heavy rain. Members are therefore advised to contact the Club as soon as possible if ships are ordered to load cargoes of Bauxite from Kuantan in Malaysia or at any port where periods of heavy rain have been experienced.**

Many cargoes of bauxite have been carried safely and provided the proper procedures are followed that should remain the case. The purpose of this article is to provide some general background information on bauxite but more importantly to reiterate practical steps that the Master, Officers and Crew can take when loading this and other Group A cargoes as well as tell-tale warning signs that should be looked for.

Numerous bulletins have been issued in recent years focusing on the potential liquefaction risk posed by bauxite cargoes originating from the Amazon and Indonesia. Recent events have served to raise questions again as to the potential risks associated with this cargo and the inadequacy of the current bauxite schedule in the IMSBC Code which, as a consequence of the very broad particle size range described under 'characteristics', in effect identifies all bauxite cargoes as being Group C.

**Bauxite**

Bauxite, like iron ore fines and nickel laterite, is a mineral ore which is simply extracted from the ground and shipped with little or no processing. As a consequence the material contains a broad range of particle sizes ranging from very fine powder all the way up to quite large rocks, although the proportion of fine material and coarse lumps varies depending on the source. However, when bauxite is processed the large lumps of ore require crushing to enable efficient extraction of the alumina – the material which is subsequently converted into aluminium. The crushing operation involves additional time and expense and as a consequence, some Chinese end-users have over the last few years changed their bauxite cargo specifications such that no lumps larger than 100mm are to be included in the shipment. This resulted in some Indonesian mines sieving the ore to remove the >100mm fraction, an operation which can involve washing the ore through a rotary sieve to produce both bauxite fines and coarser material. It is as yet unclear whether sieving is being conducted at Malaysian bauxite mines.

It is estimated that Chinese processors will require about 130 million MT of bauxite this year of which about 37 million MT is imported. Previously much of this imported ore was supplied by Indonesia but following the mineral export ban introduced in January last year, other sources have become more important, including Malaysia which is thought may supply up to about 10 million MT this year, up considerably from the 1.27 million MT shipped in the first 9 months of 2014.

**Photographs Showing Sieving in Operation at a Bauxite Mine in Kalimantan, Indonesia.**

**Close-up Photograph Showing Slurry of Bauxite Fines Underneath the Rotary Sieve.**

One of the problems with sieving is that high pressure water cannons are used to force the ore from the loading hopper into the rotary sieve (see photos above). This increases substantially the moisture content of the fines fraction to the extent that even slurries can form as shown above with the risk that the ore will not subsequently lose that moisture by natural drainage or drying (see below). Some Indonesian mines stockpile the fines separately and may ship these out as discrete parcels or mix them in with the slightly coarser ore. This is sometimes done because the fines usually have higher alumina content and are used to ensure that the alumina content of the ore, as specified in the sales contract, is maintained.

It should also be noted that the fines have higher moisture content, typically around 15% or more. This is to be expected as the water is trapped/retained between the particles of fines, as indeed is the case for all Group A cargoes. If the ore is saturated (i.e. contains water at levels in excess of that which can be held within the structure of the material), then some natural drainage is likely to occur. If such a cargo has been loaded, then drainage and accumulation of water may result in pooling of water around the periphery of the stow or in the lower reaches of the cargo stows, where, due to the presence of fines, the water may not be able to drain freely into the bilges.

Below the saturation point, water may not necessarily drain freely from the material and it is important to remember that most Group A cargoes are not saturated at the Flow Moisture Point (FMP). Thus if the ore is saturated with water draining from it and forming pools around the peripheries of the stows then the moisture content of the material is most probably above the FMP.

**Liquefaction Properties of Bauxite**

In the past, due to the presence of the large lumps within the cargo being shipped, the fines and smaller sized particles have tended to become isolated to a large degree within the stow as a consequence of them sticking to the outside of the lumps. This gives in effect a matrix of lumps (with fines present but on the lumps) with voids between them and with such a physical conformation the bauxite is free draining due to the open structure and lack of concentrated fines in which water can be retained. As a consequence such cargoes would expectedly have comparatively low moisture content, such as the 0 to 10% referred to in the IMSBC Code Appendix 1 bauxite schedule and would be Group C i.e. not prone to liquefaction.

In the absence of a relatively higher proportion of large lumps, the material becomes a matrix of fines with the lumps interspersed within it and the lumps therefore do nothing to 'isolate' the fines. As a consequence, the amount of water that can be retained within the structure of the bauxite fines increases as does the propensity for the material to lose its free draining characteristics. In addition, and of more cause for concern, the increased levels of fines and retained moisture content within the fines, increases the ore's propensity for liquefaction. Effectively, the absence of the larger lumps within the ore, can change the physical characteristics of the bauxite from Group C to Group A.

It should be noted that FMP testing using the flow table and penetration test methods upon bauxite fines and the <25mm fraction obtained from bauxite samples by sieving, has shown in a number of cases over the last 3 years that bauxite cargoes can have a FMP and thus potentially may be Group A material.

It is therefore of serious concern that the bauxite entry in the IMSBC Code indicates that to be classed as Group C, the bauxite should have a 70 to 90% proportion of particles with size range of between 2.5 and 500mm with the other 10 to 30% proportion present as powder. Such a description includes the aforementioned recently tested bauxite shipments which were shown to be Group A. In effect, the excessively broad particle range stated in the Appendix 1 schedule permits irresponsible Shippers, with little or no desire to conduct testing to determine flow characteristics, to class bauxite as a Group C cargo – even if it had a proportion of 70 to 90% particles between 2.5mm and 7mm and despite evidence which shows such a bauxite would most probably be Group A.

Overall, it is not good enough for Shippers to use the sizing currently in the bauxite Group C schedule as a "convenient excuse" for not testing or as justification for declaring the material to be Group C, since the IMSBC Code makes clear that:

"Many fine-particled cargoes, if possessing 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." (see Appendix 3, Section 2.1, page 366 of the 2013 edition).

In reality the schedule is wrong, with the potential of being dangerously so.

**What Can Be Done To Ensure Safety?**

Since it is not known what the relative proportion of particle size is required to change bauxite Group C into bauxite Group A, we would caution that potentially, many bauxite shipments, and especially those now being produced via a sieving process to remove the >100mm fraction, are potentially Group A. We strongly recommend therefore that Owners should assume that any wet or moist cargo of bauxite containing an appreciable amount of fines is Group A unless testing has shown otherwise – even if the Shippers have issued a cargo declaration stating the material to be Group C.

Onboard the vessel, the Master, Officers and Crew should, as with any potential or declared Group A cargo, conduct frequent and regular can-testing in accordance with the method set-out in Section 8 of the IMSBC Code. Development of a flat surface with signs of free moisture i.e. glistening or shiny surface, are indicative of a flow state and thus a 'fail' (see photos below).

**Before testing.**

**After can-testing.**

**Before testing.**

**After can-testing.**

The Crew should also keep a close watch for the presence of cargo splatter marks on the bulkheads, shell plating and hatch coamings as these can only arise as a result of transient liquefaction of the cargo as it is being dropped onto the developing cargo stow in the holds. The presence of such marks indicates that portions of the cargo loaded have moisture content in excess of FMP. In addition, the crew should check for accumulation or pooling of water around the periphery of the stow as this may indicate that the cargo is saturated.

**Bauxite splatter marks.**

**Water accumulation around the peripheries of bauxite stows**.

In the event of failed can tests, or the presence of splatter marks and/or pools of free water our advice would be to suspend loading until the cargo has been properly tested for flow characteristics in a laboratory.

**<u>Source of information</u>**

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