SUMMARY

Executive summary: This document contains the following proposals:
(1) to establish a Correspondence Working Group to deepen the studies on the phenomenon of liquefaction of iron ore fines in general as well as the applicability of adequate methods of experimental determination of the Transportable Moisture Limit (TML) of the cargo herein named "Iron Ore Fines", as well as of other cargoes deemed similar, and
(2) to develop a new schedule for iron ore fines in the IMSBC Code.

Strategic direction: 5.2
High-level action: 5.2.3
Planned output: 5.2.3.1
Action to be taken: Paragraph 20
Related documents: DSC 15/4/14; and DSC.1/Circ.63

Introduction

1 The names of solid bulk cargoes can vary from region to region, from shipper to shipper, etc. It is almost impossible to make a list of cargo names and their respective associated risks which would exhaust the issue. IMSBC Code recognizes this issue and dedicates its item 1.3 to "Cargoes not listed in this Code".

2 IMSBC Code lists iron ore in two different entries of its Appendix 4. In one of these entries IRON ORE is classified as belonging to "Group C" (cargoes which are not liable to liquefy nor to possess chemical hazards), while in the next line IRON ORE (concentrate, sinter feed, pellet feed) is classified as a "Group A" cargo (cargoes which are liable to liquefy if shipped above their Transportable Moisture Limit – TML).
3 The possible ambiguity created by a list which does not cover all possible cargo definitions is eliminated in item 4.2 of the IMSBC Code that acknowledges that it pertains to the shipper to give the correct information on the cargo. This includes the applicable Bulk Cargo Shipping Name – BCSN, complementing the clear guidance of its item 1.3.

4 Generally, iron ore fines originating from Brazil have high hematite content, typically between 85% and 98% by weight. Among these there are notable cases, such as iron ore fines coming from the Brazilian region known as Carajás. The latter, without concentration processes, reaches hematite contents of approximately 93% by weight. Similar cases also happen to some iron ore fines from Brazil coming from the region called Iron Quadrangle. Therefore, Mineral Concentrates schedule, as per IMSBC Code, does not apply.

5 This cargo, which includes high hematite composition and easy drainage conditions, make it a sui generis cargo. As such, iron ore fines should have an individual schedule of solid bulk cargo in the IMSBC Code.

Limitations on the application of the Appendix 2 methodologies for Transportable Moisture Limit (TML) determination of iron ore fines

6 The IMSBC Code directly refers the shipper to the tests it describes in its "Appendix 2 – Procedures for Laboratory Tests, Associated Equipment and Regulations". In it, the Code acknowledges as currently in common use three methods to determine the Transportable Moisture Limit (TML), to wit: flow table test, penetration test and Proctor/Fagerberg test.

7 Recognizing that each one of these three testing methods for cargoes liable to liquefy have advantages and disadvantages, the IMSBC Code establishes that the choice of test method should be determined by local practices approved by competent authorities or in accordance with the test procedures prescribed in IMSBC Code's Appendix 2.

8 Flow table test: the IMSBC Code acknowledges the typical scope for the application of this methodology is mineral concentrates and fine bulk solids with top-size particles of 1 mm. It acknowledges that it may be applied to materials with a maximum particle size of 7 mm. However, it determines that the flow table test will not be suitable for materials coarser than this limit. There are various iron ore fines which have a maximum particle size coarser than 7 mm and so, according to the IMSBC Code, to these cargoes the flow table test cannot be used.

9 Penetration test: the IMSBC Code recommends this methodology for mineral concentrates, similar materials and also coal of up to 25 mm. It is a technique dedicated to Transportable Moisture Limit (TML) determination. In spite of being a relatively deterministic methodology since it is an electromechanical device with a numerical verification standard, in other words, the Transportable Moisture Limit (TML) is shown when a penetration bit penetrates 50 mm into a cargo test portion under standardized conditions. However, reports of the pertinent IMO sub-committee (DSC 6/5/3, item 8) show deficiencies in the replication of this methodology for an iron ore concentrate sample (in this case, a Carol Lake Iron Ore Concentrate): two discrepant TML results – 6.8% and 7.7%. Not only is the absolute difference between these results greater than that registered in the same document for the Proctor/Fagerberg test, but also the values are different from those two results obtained by the latter TML test methodology – 9.0% and 8.7%.

10 Proctor/Fagerberg test: the IMSBC Code recommends the application of this methodology to mineral concentrates or similar materials with a maximum particle size of 5 mm. It acknowledges that its application to coarser materials requires extensive
investigation and improvement. Again, there are several iron ore fines that have a maximum particle size coarser than 5 mm and which for, according to the IMSBC Code, the Proctor/Fagerberg test cannot be applied without extensive investigation and improvement for iron ore fines and these have not been carried out yet.

11 Given the above facts, at the present stage, the methodologies set forth in the IMSBC Code are not adequate to determine Transportable Moisture Limit (TML) for iron ore fines.

Concepts related to iron ore fines, standing water and liquefaction

12 Moisture migration means the movement of moisture contained in a cargo by settling and consolidation of the cargo due to vibration and ship's motion. Water is progressively displaced which may result in some portions or all of the cargo developing a flow state. Source: IMSBC Code, item 1.7.21.

13 Standing water (also called stagnant water) in iron ore fines, occurs when, during a sea voyage, moisture migration happens in such a way and with such intensity that a liquid phase, which usually contains traces of fine solid particles coming from the cargo itself, separates from the main part of the cargo and appears, as a distinct liquid phase, separately from the cargo's main part. The main part is and remains in a solid phase and behaves as such.

14 Liquefaction is dangerous because "the resulting viscous fluid state cargo may flow to one side of the ship with a roll but not completely return with a roll the other way. Consequently, the ship may progressively reach a dangerous heel and capsize quite suddenly", as described in IMSBC Code, item 7.2 – in particular item 7.2.4.

15 In a liquefaction process, as a result of the transition from a solid state to a viscous fluid state, part of or even all of the cargo may lose its usual conical shape and can flatten out to form a fluid surface. On the other hand, standing water shall simply be pumped out of the vessels while it is being formed, according to the legislation locally applicable for pumping bilge water. Consequently, liquefaction and generation of standing water are two distinct phenomena.

16 It is important to emphasize that all seagoing solid bulk carriers are equipped with bilge wells and pumps aiming at pumping out of the holds any standing water that eventually appears during a sea voyage. Otherwise, a solid bulk carrier is not ready in all aspects to be loaded, which is a basic requirement of her readiness for carriage of iron ore fines in seagoing voyages.

17 It is also important to register that the occurrence of standing water during the seaborne transportation of Brazilian iron ore fines is relatively frequent and so may be taken as one of their characteristics. Recognizing the importance of standing water pumping out procedures during sea voyages, the major Brazilian iron ore shipper installs auxiliary filters in the bilges of vessels' holds which mitigate the ingress of solid particles into the pumping system of the bilges and this control measure has proved successful.

Proposal

18 Constitution of a Correspondence Working Group to deepen the studies on the phenomenon of liquefaction of iron ore fines in general as well as the applicability of adequate methods of experimental determination of the Transportable Moisture Limit (TML) of the cargo we herein propose to name "Iron Ore Fines", as well as of other cargoes that could be considered similar.
19 Upon conclusion of the Correspondence Working Group, invite Member States to develop a new schedule for "Iron Ore Fines" in the IMSBC Code, with proper adjustments in the "Iron Ore" schedule, if necessary.

Action requested of the Sub-Committee

20 The Sub-Committee is invited to consider the proposal above and take action as appropriate.