

SUB-COMMITTEE ON CARRIAGE OF
CARGOES AND CONTAINERS
2nd session
Agenda item 5

CCC 2/INF.20
10 July 2015
ENGLISH ONLY

AMENDMENTS TO THE IMSBC CODE AND SUPPLEMENTS

Information support for the safe transport of Bauxite

Submitted by Australia and Brazil

SUMMARY

<i>Executive summary:</i>	This document contains a summary and update of the research work on Bauxite, carried out by Australian and Brazilian industry
<i>Strategic direction:</i>	5.2
<i>High-level action:</i>	5.2.3
<i>Planned output:</i>	5.2.3.3
<i>Action to be taken:</i>	Paragraph 4
<i>Related document:</i>	CCC 2/5/22

Background

1 Australia and co-sponsors have submitted a proposal (CCC 2/5/22) to establish a correspondence group on the evaluation of properties of Bauxite, at this session of the Sub-Committee. If established, the correspondence group would discuss the outcomes of ongoing research work on the properties of bauxite and develop amendments to the IMSBC Code as necessary for discussion at the third session of the Sub-Committee.

2 Whilst the research is not complete, industry from Australia and Brazil have provided their competent Authorities with an overview of the work carried out to date and the scope and timelines for their future work.

3 The research summary report is set out in the annex to this document.

Action requested of the Sub-Committee

4 The Sub-Committee is invited to take note of the information provided in the annex to this document when considering document CCC 2/5/22.

ANNEX

RESEARCH PROGRAMME FOR THE SAFE SHIPPING OF BAUXITE

Introduction

Australian and Brazilian shippers of bauxite have embarked on research programmes to investigate the behaviour of their products during ocean transportation. The work specifically aims to understand any instabilities arising in the cargo due to its moisture content and the cyclic motion of the vessel, including the phenomenon of liquefaction.

The bauxite investigation follows that of the iron ore fines programme and represents significant investment by shipper to elucidate the real behaviour of bauxites cargoes and to ensure the continued safe shipping of this material.

Intended work programme

The current work programme is set to be completed by 2015, with peer review being undertaken in early 2016, followed by submission of the findings via the shippers' relevant competent Authorities. The research programme consists of subjecting each bauxite product to numerous test methods to understand its behaviour, as there is not yet available a single method to fully ascertain the behaviour of a bulk solid cargo undergoing ocean transportation.

The research programmes of both Australia and Brazil consist of the following investigations and tests:

- bauxite characterization – to understand the types of bauxites and their fundamental properties
 - particle size distribution
 - chemistry
 - mineralogy
 - density (minimum to maximum)
 - porosity
- fundamental geotechnical tests
 - permeability
 - shear tests
 - moisture characteristic curves
 - Cyclic Triaxial Tests (CTT)
- review of Transportable Moisture Limit (TML) tests – to determine the applicability of these test to commercially available bauxites
- small-scale physical modelling – to mimic the behaviour of bauxite cargoes during transportation and test extremes
- vessel motions analysis – to determine forces the cargoes are subjected to.
 - effect of sea state, voyage route
 - effect of vessel size

- cargo behaviour during ocean transport – to determine real world data for calibration of lab tests
 - cargo observations
 - bilge data
 - bulk density
- Stability analysis – to understand the effect of cargo shift on vessels stability.

Findings to date

Work completed to date in Australia has indicated C classification behaviour of exported bauxites while work on both Australian and Brazil bauxites continues.

Geotechnical and TML tests on Australian ores show that the material is free draining and moisture will readily pass through the spaces between the particles at high moisture levels, thus making the potential for liquefaction limited. This behaviour has been indicated in preliminary CTT work (and it is expected to be confirmed by further complementary tests) as regards no liquefaction at extreme conditions of moisture content and sea states.

More than 16 cargo observations have been conducted to date and none show any sign of cargo shift, slippage or movement of any kind. Bilge pumping records provide little to no bilge water is present in all voyages monitored.

Results to date are:

- bauxite characterization
 - bauxites have varying particle size distributions, chemistry, mineralogy and hence porosity and densities
 - geotechnical and TML test show bauxites from Australia are free draining when at high moisture levels
 - CTT at extreme moisture and sea state conditions show no liquefaction
- TML tests
 - the existing TML tests, though valid for a range of cargoes, need to have their applicability tested for bauxites because particle size requirements in the tests differ from particle sizes found in bauxites ores.
- Vessel Motion Analysis
 - simulation of forces encountered during voyages shows that tropical storms and cyclones are the main causes of extreme forces
 - small vessels encounter larger forces for the same sea states.
- Cargo observations
 - 16+ observations to date and ongoing on Australian and Brazilian bauxites
 - no cargo shift, slippage or movement observed
 - little to no water found in bilges
 - vessels encountered swells to 5.0 m and seas to 4.0 m