Cargo liquefaction – Regulatory developments and implications for ship design

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Cargo Liquefaction

SYNOPSIS

INTRODUCTION TO LIQUEFACTION – Current regulatory regime; the science of liquefaction

NICKEL ORE - Loading conditions; When liquefaction occurs – the consequences for ships/seafarers;

IRON ORE FINES – Similarities with Nickel Ore; trading patterns

SHIP RELATED ISSUES – Forces on the ship; research discussions; regulatory consequences from IMO: w/e 21 September 2012
Intercargo Work Programme

Introducing Intercargo

• INTERCARGO: International Association of Dry Cargo Shipowners, established in 1980.

• Promotion of Safety, Quality, Efficiency, Protection of the Environment and Profitability in the dry bulk shipping industry.

• More than 160 members internationally representing over 900 dry bulk vessels.

• Founder of “Round Table” of Maritime Associations with BIMCO, ICS and Intertanko.

• Observer status at the International Maritime Organization (IMO).

• Members include: China Shipping, Vale, Rio Tinto etc
Context: Newbuildings / Internationally trading fleet

- 2011: 1,100 ships delivered
- 2012 (September): 633
- 2012 scrapped (Sep): 335

- Characteristics:
  - Challenging trading conditions
  - Delivery market maturing
  - Ordering / replacement much reduced.
  - Linked to operating cost reductions?
Cargoes, hazardous

Risks to ships / seafarers

- Liquefaction (e.g. Nickel Ore)  
  (Category “A”)
- Chemical, fire & explosion (e.g. DRI)  
  (Category “B”)
- Others (e.g. environmental hazards,  
  Neither A nor B =  (Category “C”)
- IMSBC mandatory since Jan 2011  
  with two-yearly updates to schedules
Group A Cargoes: Liquefaction

Bulk Cargoes consist of individual particles:

- Under extreme circumstances the solid behaves as a liquid = Liquefaction

- **IMSBC Code, Section 7.1.1:** “Cargoes may appear to be in a relatively dry granular state when loaded, and yet contain sufficient moisture to become fluid under the stimulus of compaction & vibration which occurs during the voyage”

- Liquefaction may occur when the moisture content (MC) exceeds the Transportable Moisture Limit (TML) which is 90% of the Flow Moisture Point (FMP)

If water separates the individual particles then this strength is lost.
Liquefaction – Consequences and Control Mechanisms

- Over 15 months in 2010-11, 4 ships sank with 66 lives lost
- Loss of stability = grounding or total loss
- Regulations tightening & public opinion against irresponsible stakeholders, especially ashore
- Regulatory Oversight by the Competent Authority at the port of loading = Governments
- Commercial – receivers view
Context: The Nickel Ore trades

- Nickel Ore trade
  - Indonesia, Philippines, New Caledonia
  - 45m tonnes shipped in 2011, mainly to China
  - Indonesian Export tax: May 2012 – 50% + reduction in shipments

- Smaller ships: Supramax and below

- Casualties
  - Jian Fu Star, Nasco Diamond, Hong Wei and Vinalines Queen
  - 66 lives lost in just over 12 months
  - Concerns: sampling, testing, certification, stockpile management
Cargoes: Liquefaction – Nickel Ore
Cargoes: Liquefaction
Intercargo Work Programme

Cargoes: Liquefaction – Nickel Ore
Nickel Ore – balancing the responsibilities / addressing failures

Shipper
- No misrepresentation: correct BCSN name
- Sampling, testing and controlling the moisture content
- Allow access to stockpiles
- Competent Authority independent of shipper

Chartering Department
- Refuse C/P clauses banning independent surveys

Owner
- Awareness campaign with Master; P&I mandatory pre-notification from June 2012
Intercargo Guide for the Safe Loading of Nickel Ore (1 Feb 2012)

Aims to:

• Raise awareness

• Engage multiple stakeholders

• Encourage due diligence

• Identify responsibilities

• Ship cargo safely
Intercargo Guide for the Safe Loading of Nickel Ore: What Should I look For?

- Shipper's Declaration provided? **Yes/No**
- Correct BCSH used? **Yes/No**
- TML Stated? **Yes/No**
- Moisture content (MC) certified? **Yes/No**
- MC < TML? **Yes/No**
- Visual Inspection OK? **Yes/No**
- Load? **Yes/No**
- Visual monitoring OK? **Yes/No**
- Continue Loading? **Yes/No**
- Stop Loading? **Yes/No**

Shipper's Declaration: It is a legal requirement under the provisions of SOLAS Chapter VII, Regulation 2 and the BCSR Code Section 4.2 for the shipper to provide accurate cargo information to the Master.

Correct BCSH: All dry bulk cargoes should be shipped under their correct Bulk Cargo Shipping Home (BCSH). Nickel Ore does not have its own schedule in the BCSR Code and hence has no BCSP. A cargo not listed in the Code should be shipped under Section 1.2 of the Code under a “transportation agreement.” However, in the absence of such agreements, a cargo known to be prone to liquefaction (Nickel Ore should be transported under Section 7 of the Code) that may liquefy as a “Group A” cargo.

TML: As a cargo prone to liquefaction it is essential Nickel Ore is classified as Group A and the accurate Flow Assessment Point (FAP) must be determined in accordance with the BCSR Code and the Transportable Moisture Limit (TML) stated in the cargo declaration.

Moisture Content (MC): The actual moisture content of the cargo to be loaded must be provided by the shipper in accordance with the BCSR Code from samples taken no more than seven days prior to loading. If moisture content of the cargo is likely to have changed since the samples were taken, e.g., due to rain, further samples should be taken and the moisture content re-certified.

MC = TML: The actual moisture content must be below the Transportable Moisture Limit. If not the cargo must not be loaded.

Visual Inspection: As far as practicable the owner’s representative or ship’s crew should visually inspect the cargo stockpiles prior to loading. If such inspection or any associated “eye tests” (undertaken under section 5 of the BCSR Code) cast doubt upon the accuracy of the cargo declaration the cargo must not be loaded and advice sought.

Load: The cargo should be loaded in accordance with the provisions of SOLAS Chapter VII, the Code of Practice for the Safe Loading and Unloading of Bulk Cargoes (the BCSR Code), and the BCSR Code including trimming requirements under section 5.

Visual monitoring: Visual monitoring should be carried out during loading and/or if indications of high moisture content are observed, such as free water or cargo spalling, loading must stop and advice be sought.

*Independent Testing: Where doubt exists concerning any cargo declaration information as a certification shows MC without a below TML and yet the cargo appears wet (e.g., when loaded), or there is suspicion that the cargo has been mis-represented, independent cargo testing to determine the FAP, TML, and actual moisture content of the cargo to be loaded should be carried out.

**Care Tests** may indicate when a cargo has exceeded its FAP - confirming the cargo should be rejected and independent re-testing carried out. The Care Test cannot demonstrate the cargo moisture content is less than the TML, this can only be determined by laboratory tests. A cargo cannot be accepted for loading based on Care Tests alone.
Cargoes, hazardous – ‘Group A’: Liquefaction (iron ore fines)
Cargoes: Liquefaction – Iron Ore Fines – the trades

- Very significant trade
- Many loading countries including Brazil and Australia
- Geological differences, moisture and “free water”
- Test methods used for analysis of materials
  - Flow Table test
  - Penetration test
  - Proctor Fagerberg test
Cargoes: Liquefaction – Iron Ore Fines and DSC.1/Circ 66

West of England: Loss Prevention Circular

Sinter feed loaded at Ponta da Madeira after liquefaction onboard

Sinter feed covered by free water which developed on passage
Cargoes – Iron Ore fines: Recent developments

- Industry (P&I and Round Table visit to Vale: May 2012

- Interim results ex Brazil (Vale) & Australia (RTZ/BHP) at IMO DSC 17 w/end 21 Sep 2012

- DSC 18 (Sep 2013) to finalise IoF schedule: e.i.f 1.1.2017

- IMO Circ 66 “as is” until finalisation but with “early implementation”.
Cargoes: Iron Ore Fines & Implications for Ship design

- High level but informal Technical Working Group to be formed to progress / harmonise the results of the Australian / Brazilian studies

- Alternative test methods “controversial“

- Non-ship considerations
  - Stopping during rain
  - Blending low M.C materials
Cargoes – liquefaction and Ship-forces / design considerations

• Structural responses to motion / 6 Degrees of freedom
  – Slamming
  – Whipping
  – Bending

• Vibration of engine and the propeller

• Ship size (acceleration less in larger ships ?)
Cargoes – liquefaction and Ship-forces / design considerations (2)

- Length of voyage

- Bilge pumps and proprietary Bilge Filters

- “First-aid” : liquefaction en route

- Cargo pile height / dimensions

- Liquefaction in cargo next to shell plate & bulkheads
Cargoes: SCCS

Are Specially Constructed Cargo Ship (SCCS) designs the way forward?
Summary: Main issues for consideration

- Safety - the driver
- IMO Regulation mainly targeting operational issues
- 2013 research on Iron Ore Fines from Brazil and Australia to include ship characteristics.
- Specially Constructed Ships – niche only?
Thank you!
Any questions?

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