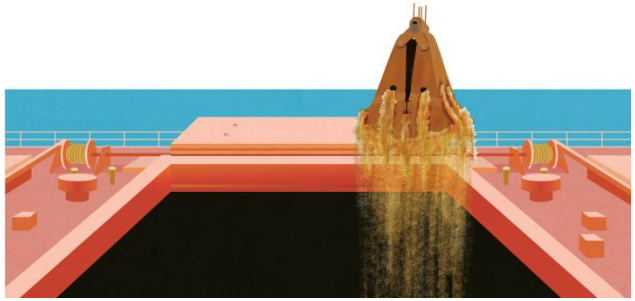
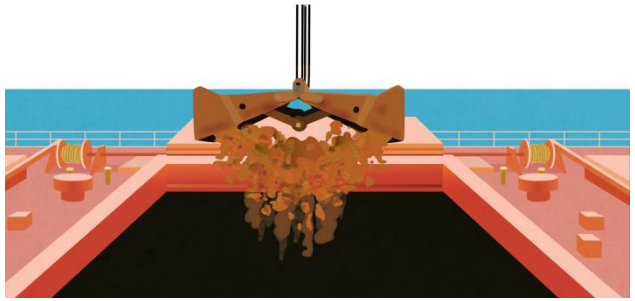
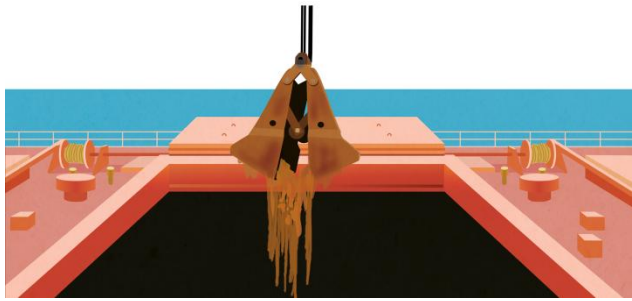
Liquefying Bulk Cargoes

Lessons learned about nickel ore

AIMU

MARINE INSURANCE DAY SEMINAR

27 September 2013

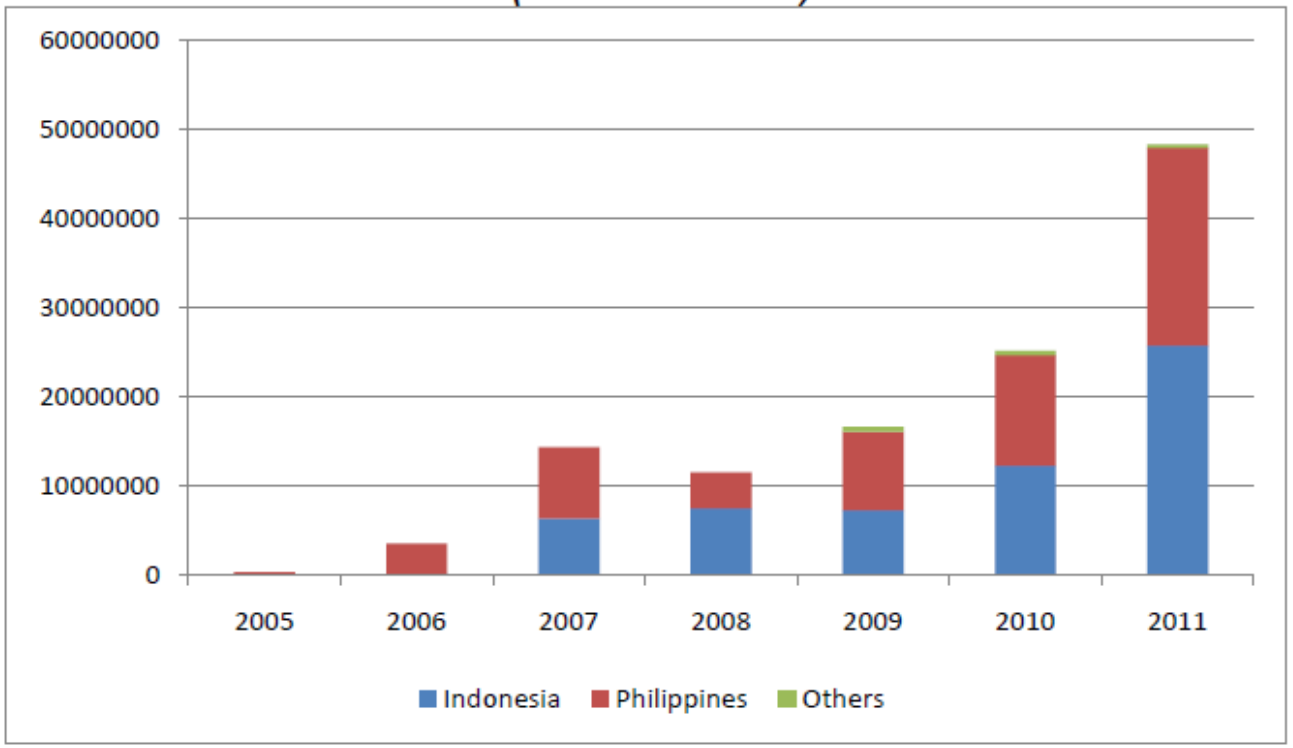
William Moore, Dr. Eng.
Senior Vice President
The American Club
New York, NY

Overview

- Concerns about nickel ore
- Demand for nickel ore
- International regulations: IMSBC Code
- Characteristics of liquefaction
- Risks to vessel
- Ship staff controlling loading?
- Compliance with IMSBC Code: What is really going on
- Insurance considerations?
- What do we do next?

Nickel ore demand

- Significant demand for nickel ore in China as it is the principle alloy component for stainless steel



Source: INSG

2012 at 50k tons/shipment

Nickel ore incidents

- **27 October 2010**: JIAN FU STAR sank while carrying nickel ore from Indonesia to China. **(13 fatalities)**
- **10 November 2010**: NASCO DIAMOND sank while carrying nickel ore from Indonesia to China. **(21 fatalities)**
- **03 December 2010**: HONG WEI sank while carrying nickel ore from Indonesia to China. **(10 fatalities)**
- **25 December 2011**: VINALINES QUEEN went missing. One sole survivor. **(22 fatalities)**
- **16 February 2012**: HARITA BAUXITE sank while carrying nickel ore from Indonesia to China off of western Luzon, Philippines. **(15 fatalities)**

HARITA BAUXITE

The latest nickel ore incident…

TRANS SUMMER … luckily, no fatalities.

Some sobering statistics

- As of January 2012, nickel ore trade made up only **0.06%** of bulk shipping world trade... but **80%** of the fatalities in bulk carrier trade
- The Chinese nickel ore trade has approximately **4 times** the rate of all seafarers killed by pirates around the world annually.

IMO regulations

International Maritime Solid Bulk Cargoes (IMSBC) Code

- Adopted on 4 December 2008 by IMO Resolution MSC 268(85)
- Majority of IMSBC Code is mandatory through additional provisions made to Chapters II, VI, VII to the International Convention for the Safety of Life at Sea, 1974 (SOLAS Convention) as of 1 January 2011

IMO regulations (cont.)

IMSBC Code: Hazards of concern and objectives

- Code addresses hazards of carriage of bulk cargoes associated with:
  - ✓ structural damage due to improper cargo distribution;
  - ✓ loss or reduction of stability during a voyage; and
  - ✓ chemical reactions of cargo.
- Code objectives are to:
  - ✓ facilitate safe stowage and shipment of certain bulk cargoes;
  - ✓ provide information on dangers associated with shipment of certain cargoes; and
  - ✓ provide instructions on procedures to be adopted for those cargoes.

IMO regulations (cont.)

IMSBC Code Overview: Code sections

- ✓ General provisions
- ✓ General loading, carriage and unloading precautions
- ✓ Safety of personnel and ship
- ✓ Assessment of acceptability of consignments for safe shipment
- ✓ Trimming procedures
- ✓ Methods for determining angle of repose
- ✓ Cargoes that may liquefy
- ✓ Test procedures for cargoes that may liquefy
- ✓ Material processing chemical hazards
- ✓ Carriage of solid waste in bulk
- ✓ Security provisions
- ✓ Stowage factor conversion tables
- ✓ References to related information and recommendations

IMSBC Code Terminologies

- ✓ **Flow moisture point (FMP)**: percentage moisture content (wet mass basis) at which a flow state develops "*under prescribed methods of testing*"
- ✓ **Transportable moisture limit (TML)**: maximum moisture content of the cargo which is considered safe for carriage

Getting down to “brass tacks”

Cargo declarations

Cargo information: SOLAS Chapter VI, Part A, Regulation 2(1)

“The shipper shall provide the master or his representative with appropriate information on the cargo sufficiently in advance of loading…”

“Such information shall be in writing…”

Getting down to "brass tacks" (cont.)

Identification and classification of cargo

Cargo testing: IMSBC Code, Section 4, Regulation 4.1.4:

"Bulk cargoes shall be classified… in accordance with the *UN Manual of Tests and Criteria*, part III."

"The various properties of a solid bulk cargo… shall be determined… in accordance with the test procedures approved by a competent authority in the country of origin…"

Getti acks" (cont.)

Cargo in

IMSBC Cc ormation to be provided ocuments include…

FORM FOR CARGO INFORMATION
for Solid Bulk Cargoes

BCSN	
Shipper	Transport document Number
Consignee	Carrier
Name/means of transport Port/place of departure	Instructions or other matters
Port/place of destination	
General description of the cargo (Type of material/particle size)*	Gross mass (kg/tonnes)
Specifications of bulk cargo, if applicable: Stowage factor: Angle of repose, if applicable: Trimming procedures: Chemical properties if potential hazard*: * e.g., Class & UN No. or "MHB"	
Group of the cargo ☐ Group A & B* ☐ Group A* ☐ Group B ☐ Group C	* For cargoes which may liquefy (Group A and Group A & B cargoes) Transportable Moisture Limit Moisture content at shipment
Relevant special properties of the cargo (e.g., highly soluble in water)	Additional certificate(s)* ☐ Certificate of moisture content and transportable moisture limit ☐ Weathering certificate ☐ Exemption certificate ☐ Other (specify) * If required
DECLARATION I hereby declare that the consignment is fully and accurately described and that the given test results and other specifications are correct to the best of my knowledge and belief and can be considered as representative for the cargo to be loaded.	Name/status, company/organization of signatory Place and date Signature on behalf of shipper

Getting down to "brass tacks" (cont.)

Certificates to tests

- Cargo testing: IMSBC Code, Section 4.3, Regulation 4.3.1:
  "…the shipper shall arrange for the cargo to be properly sampled and tested."
- Cargo testing: IMSBC Code, Section 4.3, Regulation 4.3.2 states the shipper shall provide:
  - ✓ a signed certificate of TML
  - ✓ TML certificate shall contain or be accompanied by results of TML tests
  - ✓ a signed certificate or declaration of the moisture content

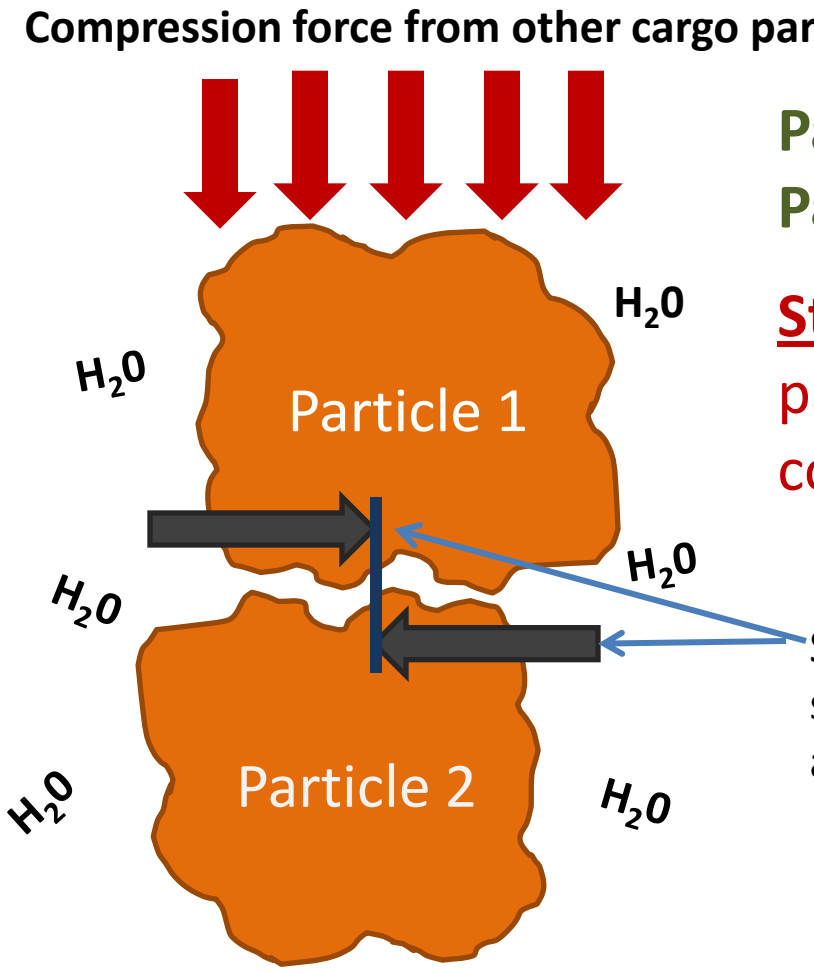
Getting down to "brass tacks" (cont.)

Sampling procedures

Cargo testing: IMSBC Code, Section 4, Regulation 4.4 are to take into account important factors such as:

- ✓ Type of material
- ✓ Particle size distribution
- ✓ Manner of which material was stored
- ✓ Variations in moisture distribution through consignments
- ✓ Characteristics to be determined: TML, angle of repose, bulk density/stowage factor

How does liquefaction occur?

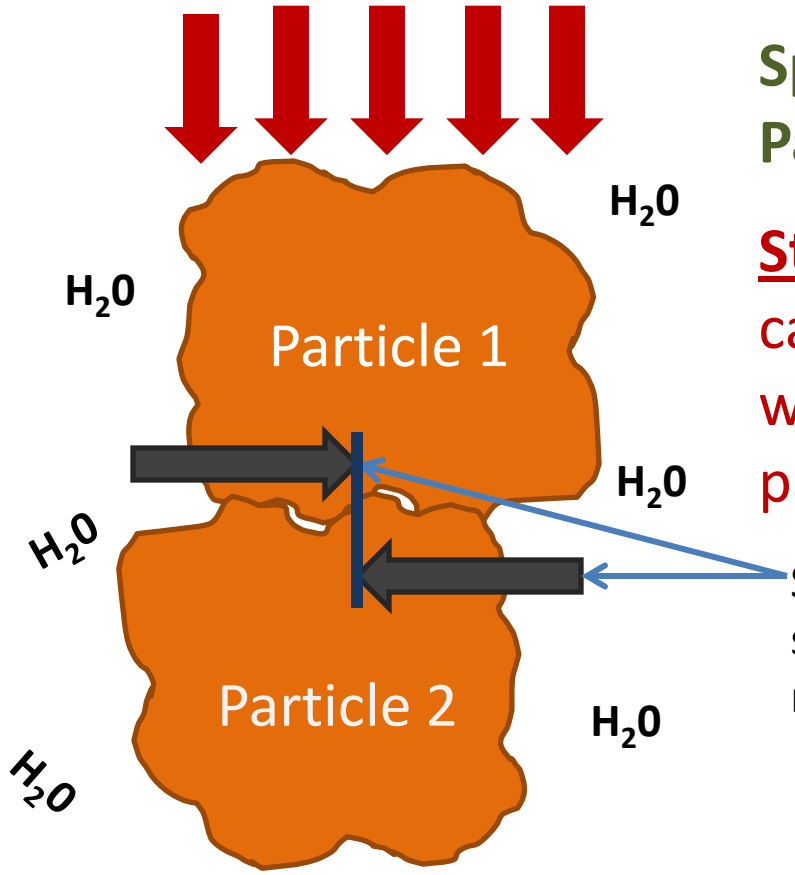


Particle 1 compressing down on Particle 2

Step 1: Volume of space between particles reduce as cargo is compacted owning to ship motion

Sufficient equal and opposite sheer forces between Particle 1 and Particle 2

How does liquefaction occur? (cont.)

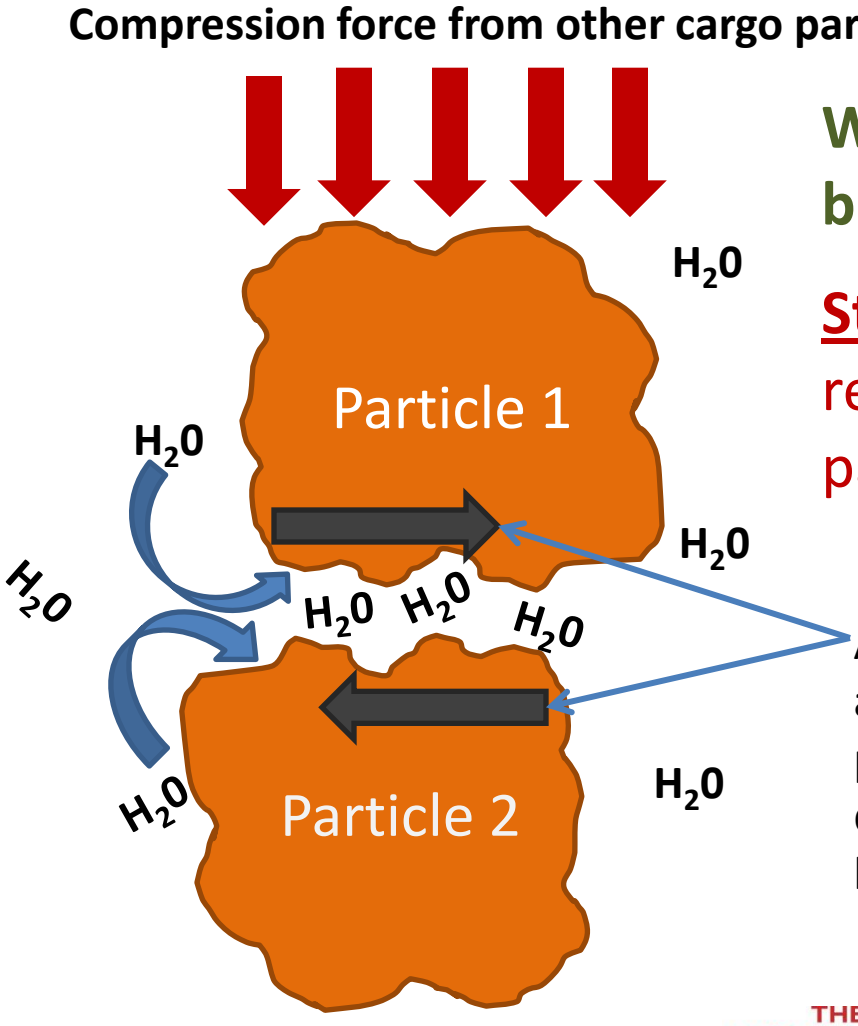


Space between Particle 1 and Particle 2 is further reduced

Step 2: Reduction in space between cargo particles causes an increase in water pressure in the space between particles

Sufficient equal and opposite sheer forces between particles maintained

How does liquefaction occur? (cont.)

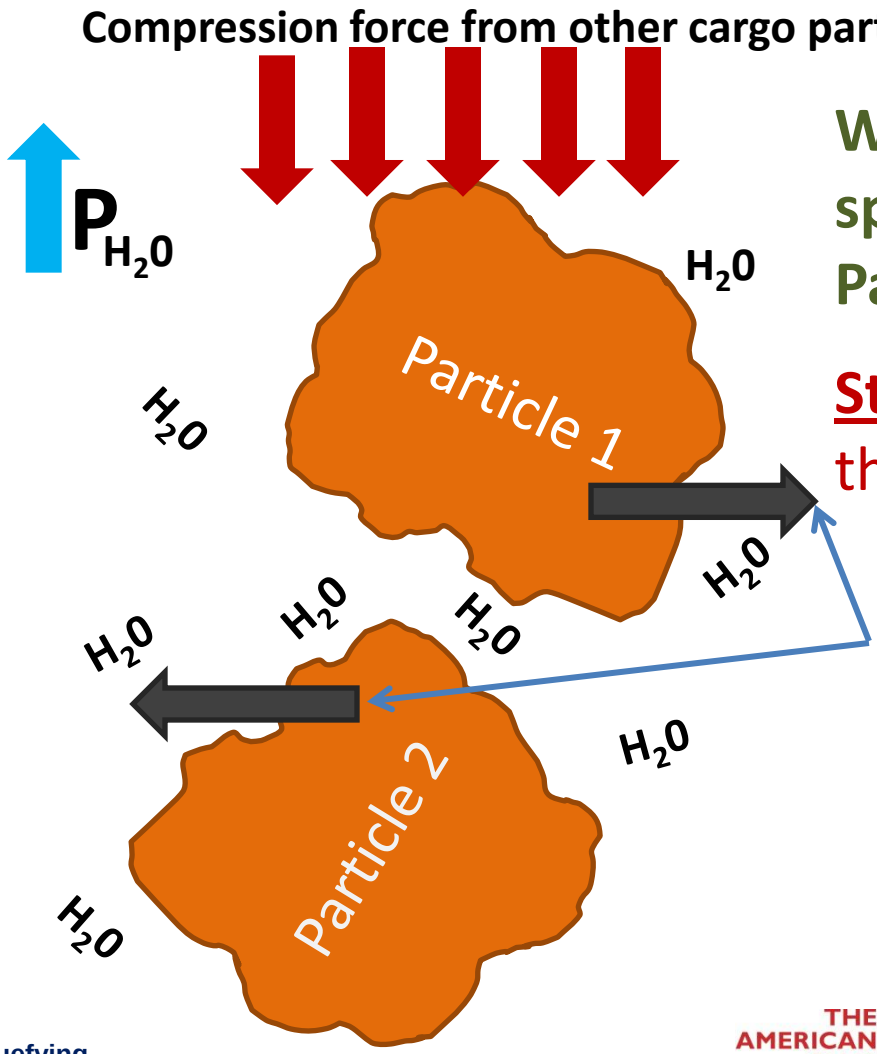


Water pressure forces water between Particle 1 and Particle 2

Step 3: Increase in water pressure reduces the friction between cargo particles

As water pressure increases and forces itself between particles, sheer pressure decreases as space widens between particles

How does liquefaction occur? (cont.)



Water pressure forcing water into space between Particle 1 from Particle 2 leads to further separation

Step 4: Reduction in sheer strength in the cargo and the cargo liquefies!

How does liquefaction occur? (cont.)

Liquefaction does not occur when…

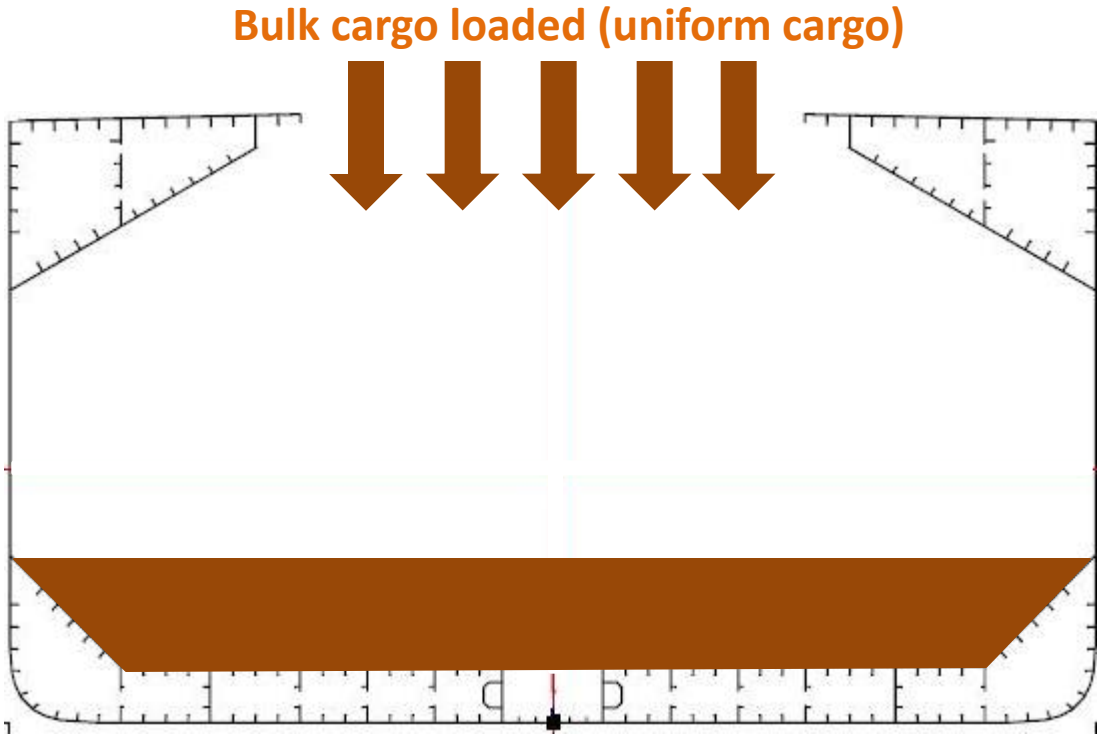
- **Cargo carries many small particles**. particle cohesion and restrictions on water pressure
- **Very large particles or lumps**. Water is able to pass easily between particles without an increase in water pressure.
- **Cargo contains a high percentage of air and low moisture content**. Increase in water pressure is inhibited and dry cargoes are unable to liquefy.

Liquefaction may occur when…

- **Moisture content exceeds the TML**.

Moisture migration

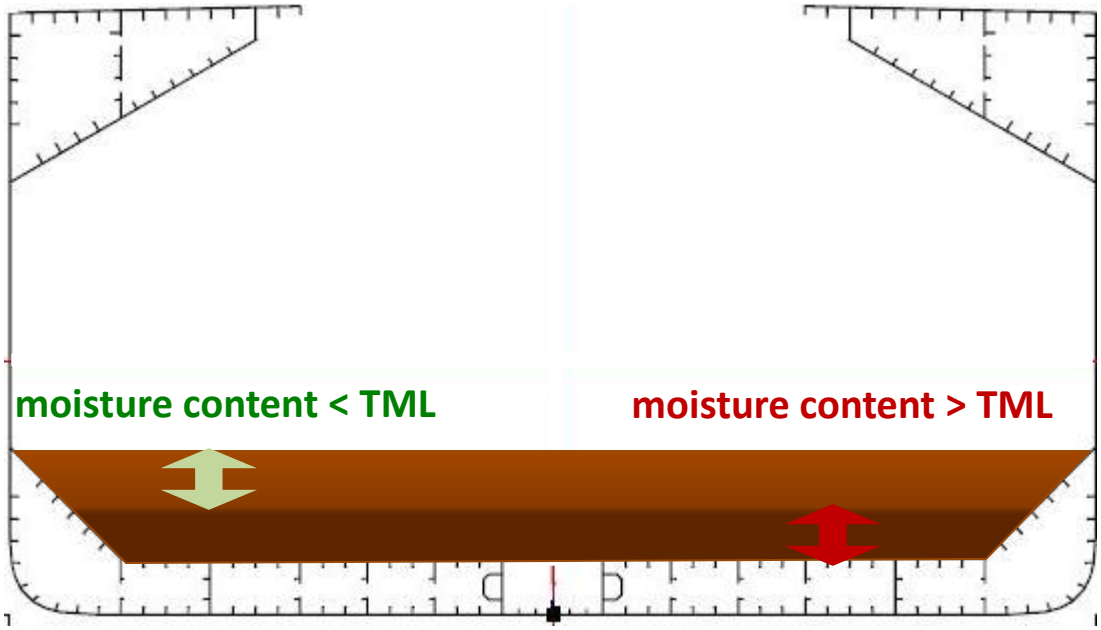
Uniform loaded bulk cargo with moisture content < TML



HARITA BAUXITE cargo holds

Moisture migration (cont.)

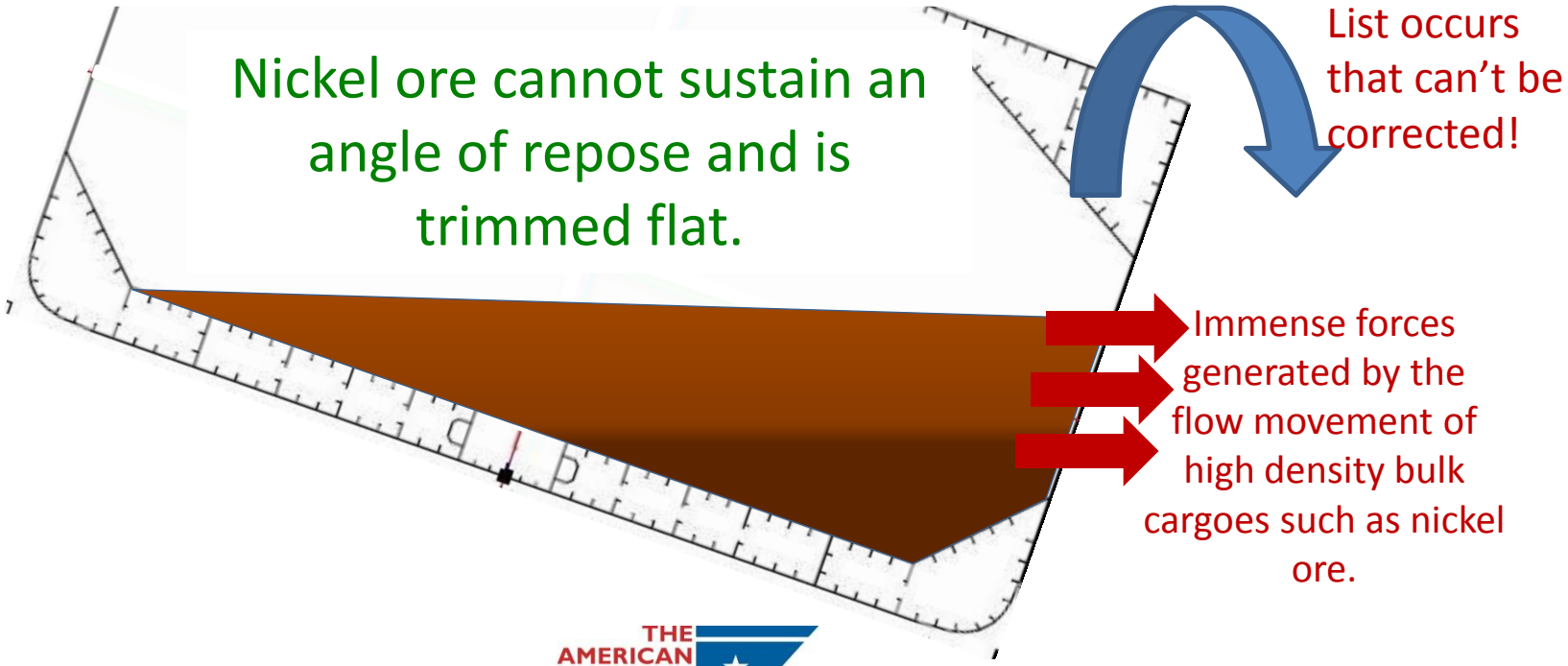
Water migrates via gravity…



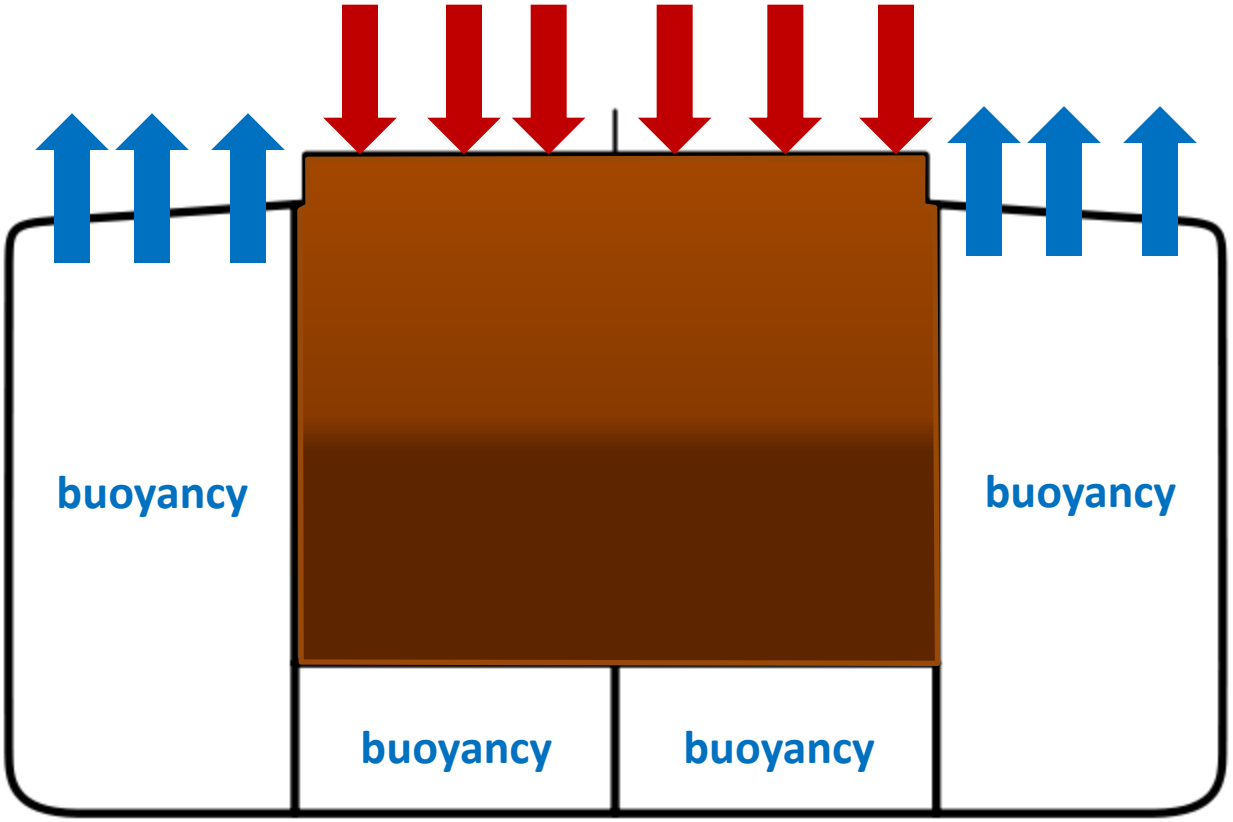
Moisture migration (cont.)

Cargo testing: IMSBC Code, Section 7, Regulation 7.3.2

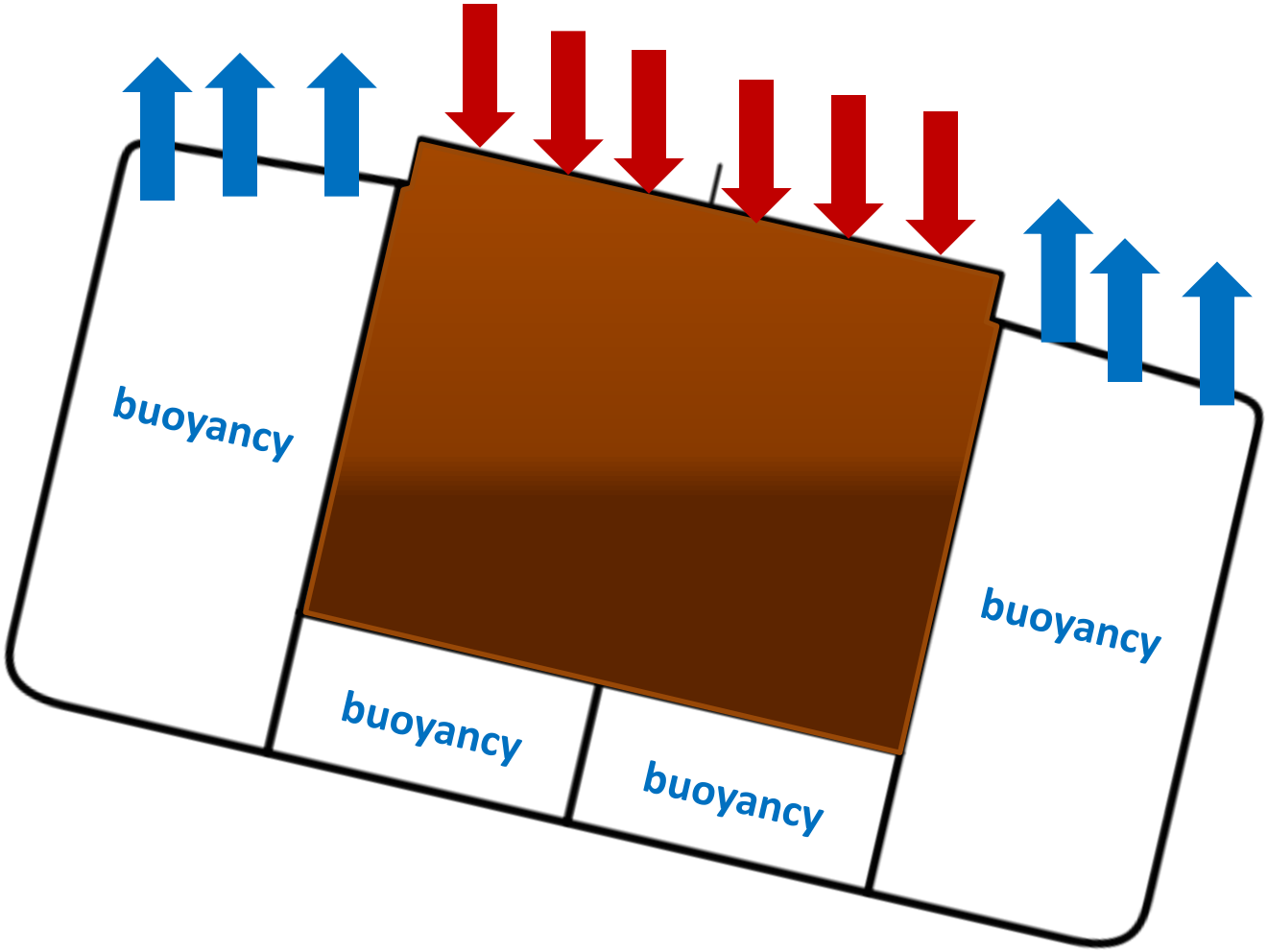
"…the cargo surface may appear dry, undetected liquefaction may take place resulting in shifting of cargo. Cargoes with high moisture content are prone to sliding, particularly when the cargo is shallow and subject to large heel angels."



Designed to carry Group A cargoes?



Designed to carry Group A cargoes?



What can the crew do?

Pre-Loading/Loading

- Visual inspections of cargo prior to and during loading
- Can tests at loading: IMSBC Code calls can testing "complimentary"
- Question/verify moisture content figures in the cargo declaration

Voyage

- Regular visual checks of the cargo surface
- Daily cargo hold bilge soundings

What can the crew do? (cont.)

But… BEWARE!

Pre-Loading/Loading

- A negative can test result does not necessarily mean the cargo is safe for shipment
- Even when the cargo appears to be dry, it may still contain moisture in excess of the TML

Voyage

- Regular visual cargo surface inspections may not reveal cargo condition
- If there is free water, the cargo might be expected to drain… but the cargo can hold the moisture and develop a wet base

What is really going on?

TRIMEGAH BANGUN PERSADA
General Trading and NICKEL MINE

PT. TRIMEGAH BANGUN PERSADA
Jl. Yasin Gamsugi No.94 RT.003 / RW.02
Kelurahan Makasar Timur
Ternate 97724 – Maluku Utara

DECLARATION OF QUALITY

As per shipment of [redacted]

This is to declare that the Laterite Nickel Ore, carried on the above mentioned vessel content as follows:

Ni : 1.90 PCT (Min)
H_2O : 35.00PCT (Max)

→ **H_20: 35%???**

Kawasi, February 10th, 2013
Ref : 57-doq 0213

Sign on behalf of
PT. TRIMEGAH BANGUN PERSADA

Eddy Suwardy
General Manager

M/V DELPHIS
PANAMA

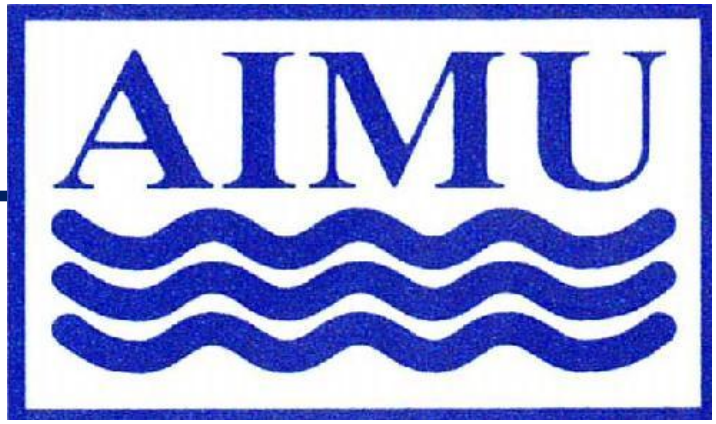
Master

MV. DELPHIS

Insurance considerations

- Pollution (bunker) claims
- Wreck removal
- Crew claims: injury and death
- Bills of Lading: shipper's liability
- Charterparty dispute
- P&I policy
- H&M policy
- Cargo insurance

Summary



- 81 seafarers have lost their lives since October 2010 on ships carrying nickel ore.
  Sadly, there are likely more to come.
- **<u>Regulations are lagging far behind the realities of the nickel ore trade.</u>**
- Political, economics and commercial interests and pressures make any significant progress difficult.
- Industry stakeholders (e.g. Intercargo, BIMCO, IG Clubs) undaunted but challenged to produce unified solutions
- If a ship sinks carrying nickel ore… it is more than likely the nickel ore.

Questions