The deadliest cargo

Nickel ore has recently been described by Intercargo as the deadliest cargo in the world. This label is understandable, given the statistics, but what is behind it?

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While I do not claim to be an expert on the scientific properties of nickel ore per se, I have investigated vessel loss and interviewed surviving seafarers from such disasters. I appreciate the opportunity to help increase awareness of this serious problem. In this article, I will touch on a couple of the regulatory aspects of the carriage of nickel ore, but above all I will focus on how and why it can go wrong.

There is significant demand for nickel ore in China as it is the principal alloy component in stainless steel. Nickel ore exports from Indonesia and the Philippines have been increasing at a rapid rate, and are now somewhere north of 55 million tonnes a year – almost double what they were in 2010. The tragic statistic in this discussion is that, since 2010, five ships have been lost with the loss of over 80 seafarers.

At the inquiry into the sinking of the *Derbyshire* many years ago, someone was reported as saying 'When your ship sinks in a typhoon, it's something to do with the typhoon.' Now it can be said that 'When your ship sinks while it is carrying nickel ore, it's something to do with the nickel ore.' More specifically, it is liquefaction. The nickel ore contains sufficient water content to allow it under certain circumstances to flow like a liquid and to cause the vessel to lose stability.

Some recent casualties

The *Harita Bauxite*, (top right) loaded at Obi Island in Indonesia.

Recent losses of ships carrying nickel ore

- 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 2013: *Harita Bauxite* sank off western Luzon, Philippines, while carrying nickel ore from Indonesia to China. (15 fatalities)

Four days into its voyage to China, the *Harita Bauxite* stopped at sea to carry out engine repairs. After stopping, the ship capsized in less than 30 minutes and sank in 4,000 feet of water off the Philippines. The surviving crew recounted some astonishing stories:

- The Chief Officer undoubtedly saved the lives of at least three of his shipmates, leading them down the starboard main deck as the vessel capsized, then scaling down a deck fire-main which was by now vertical and using the handrails at the transom as a ladder to climb down before stepping off into the sea.
- The second engineer and oiler ran up the engine room stairs while they were still almost vertical, barely escaping in time.
- The third officer was on watch on the bridge throughout the incident. He recalled seeing the Captain at the GMDSS station trying to send a Mayday. As the vessel capsized he made his way out onto the starboard bridge-wing and walked up the side of the bridge, stepping off into the sea by the radar mast and grabbing on to an oil drum.
- The Chief Cook survived the sinking, but succumbed to a shark attack during the night, prior to being brought on to a life raft by surviving crew members.

Sadly, 15 of the crew were lost. Many were in the engine room and stood no chance of escaping.

The *Trans Summer* (centre right) is the latest casualty, but thankfully the particular circumstances of that case and the vessel's proximity to land meant that there were no fatalities. Had this latest casualty followed the pattern of others, we could be looking at over 100 seafarers dead in just three years.

How can we improve safety?

Key issues are:

- Moisture content;
- Flow Moisture Point (FMP) – that is, the percentage moisture content at which a flow state develops 'under prescribed testing conditions';
- Transportable moisture limit (TML) – the maximum moisture content of the cargo which is considered safe for carriage.

So, as long as the moisture content is below the TML, everything should be safe, right?

In theory, yes. However, in one example of a cargo certificate issued by the shippers prior to loading, the certificate stated that the FMP was 40.05%, the TML was 36.85% and the moisture content at shipment was 33.86%. Based on those figures, transport of the cargo should have been no problem. But the state of the cargo on arrival (third picture from top) told a very different story.

This cargo was loaded on to another ship at Obi Island at the same time as the *Harita Bauxite*. The P&I Club dispatched a surveyor to the discharge port to take cargo samples, which were analysed by a laboratory in Hong Kong. The results bore no resemblance to the figures on the cargo certificate produced by the shipper. And this is the problem. The certificates are not representative of the cargo being loaded.

Moisture migration

One problem is that of moisture migration. Loading cargo from barges can take some time. Different particle sizes and different water content can produce a non-homogenous mixture (Fig 1). During the voyage, moisture can migrate causing a wet base to develop (Fig 2). Even then, capsizing still seems to need a catalyst. In the case of the *Harita Bauxite*, that catalyst was stopping at sea, but it could be a course alteration or heavy weather.

What can the crew do?

Pre-loading/loading

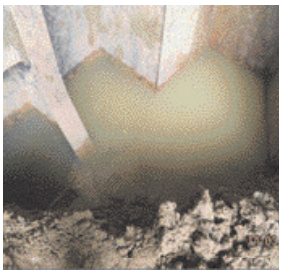
- Visual inspections of cargo prior to and during loading;
- Can-tests at loading: IMSBC Code 'complimentary' questions/verify moisture content figures in the cargo declaration.

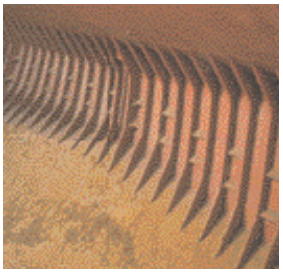
During the voyage

- Regular visual checks of the cargo surface;
- Daily cargo bilge soundings.

But beyond that, there is not much more that can be done. Holds are only about 1/3 full by volume (see bottom right), leaving plenty of room for sloshing once liquefaction has occurred. Disturbingly, the hatches can be opened at sea and the surface of the cargo inspected daily but there may be no visible change and there may be no water accumulation in any of the hold bilges. As noted in the IMSBC Code: 'The cargo surface may appear dry, undetected liquefactions 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 angles.' (see diagrams below)

Proper laboratory analysis of multiple samples from all stockpiles of cargo to be loaded is the answer, but this has proved very difficult to guarantee in remote mining areas unless you have a particularly well-informed owner. Even then, we have witnessed the intimidation of surveyors.





What else can be done?

There are ships that can carry this cargo without concern for moisture content. The *Jules Garnier II*, delivered to owners in September 2012, is the first vessel in the world to be recognised as a specially constructed cargo ship for the carriage of nickel ore in accordance with the IMSBC Code. Dedicated ore carriers of this type could be a solution, but there are not currently sufficient numbers of these vessels to move the amount of nickel ore being exported from Indonesia.

Perhaps the cargo should be mixed with water and carried in tankers?

Situation at a glance

- Eighty-one seafarers have lost their lives since October 2010 on ships carrying nickel ore. Sadly, there are likely to be more to come.
- Regulations are lagging far behind the realities of the nickel ore trade.
- Industry stakeholders (eg Intercargo, BIMCO, IG Clubs) face a major challenge in producing unified solutions.
- Political, economic and commercial interests and pressures make any significant progress difficult. Recently cargoes have been rejected when properly analysed only to be carried by other vessels. In other cases owners have not tried to obtain any proper laboratory support for figures entered into cargo declarations and have prejudiced their P&I cover.

Where is the outrage?

Thirty-one people lost their lives on the *Costa Concordia*. There was public outrage and multiple criminal prosecutions are being pursued. Redesign of cruise ships is being called for.

Eighty-one seafarers have lost their lives carrying nickel ore since October 2010. Nickel ore carriage represented just 0.06% of world trade in that time, but resulted in 80% of deaths at sea. There is as yet no legislation to prevent this from this happening again.

This article is adapted from a presentation to the Association of Average Adjusters of the United States and Canada, delivered as part of a panel on the subject: 'Watery graves & broken backs.' For additional material on this general topic, please see www.american-club.com. A pocket-sized guide to safe carriage of bulk cargoes under the IMSBC is also available.

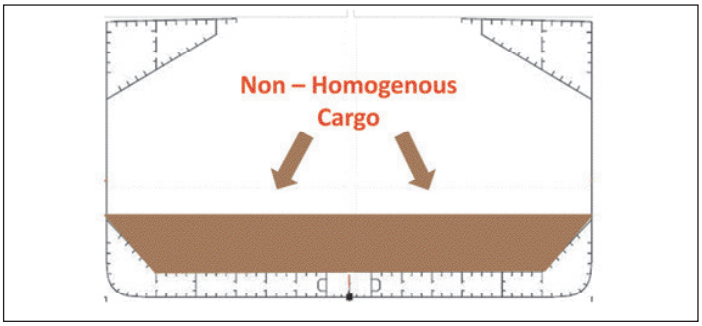


Fig 1: Moisture migration

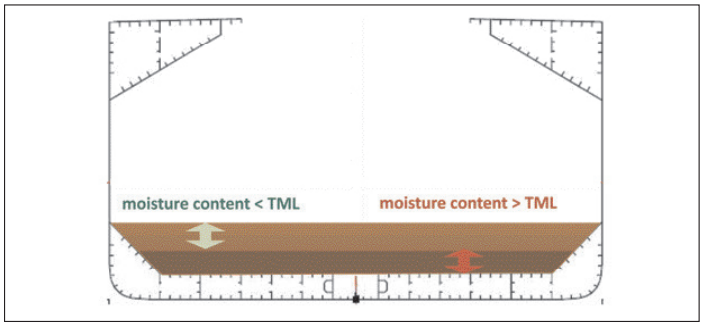


Fig 2: Moisture migration