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(a) in relation to any clause which excludes losses from the cover, insurers may agree a separate insurance policy covering such losses or may extend the clause to cover such events;  
(b) in relation to clauses making cover of certain risks subject to specific conditions each insurer may alter the said conditions”.

27/02/12

## LIQUEFACTION AND BULK CARRIER TOTAL LOSSES: KEY ISSUES

A paper by the Joint Hull Committee's Risk Assessment Sub Committee

### 1. What is Liquefaction?

**Definition: the process of converting a substance from its solid or gas state into its liquid state**

Liquefaction is simply illustrated. Suppose a bottle of ketchup is turned upside down but nothing appears; the answer is to put the lid on, shake the bottle and the sauce then comes out easily – it has experienced liquefaction.

In more scientific terms, in its solid state the particles of a concentrate are held together by friction. Certain cargoes, particularly nickel ore and iron ore fines, have the characteristics of a solid but one where moisture content directly affects the state and behaviour of the concentrate under certain conditions.

In the event there is sufficient moisture in the cargo, external agitation can increase the water pressure inherent within the concentrate, pushing particles apart. The material then undergoes a sudden transition, friction is lost and the cargo begins to behave like a liquid with the resulting free surface effect creating sudden and major stability problems for the vessel. This variability in state is key to the additional risk that carriage of these types of cargo represents to marine underwriters, particularly hull insurers.

### 2. Summary of Issues for hull Insurers

- There have been a series of total losses and near misses caused by liquefaction of cargo, including modern tonnage
- The risk is localised in terms of tonnage, cargoes, loading and discharge ports and regulation
- Specific risks of this type are relatively easy to identify
- Efforts are being made at international level to alleviate the problems faced by vessels and their crews - the insurance market is supporting these efforts
- Underwriters should not rely on local or international regulation to control their risk, and
- The issue affects reinsurance contracts just as much as direct policies

### 3. Background



*Indonesian Nickel Ore Mine*

This is certainly not a new phenomenon – over the past 5 years, several organisations have published excellent bulletins on the subject (referenced under further reading).

Once mined, the material is often stored outside in the open air rather than in warehouses and is exposed to the elements unless large scale covers are employed. The risk of rain and ensuing water contamination of the raw material can be high and the tolerances of such materials before they change states are low. The margin of safety is thin.

Bulk carriers are designed for lifting largely high density bulk dry cargo. A typical bulk carrier's hold configuration is not designed to cater for a cargo which exhibits free surface effect. In the event that cargo is loaded in a moist or wet condition that exceeds certain tolerances, it is highly likely that due to the vessels' movement at sea the cargo will turn into slurry.

This cargo liquefaction can result in serious stability problems that are not easily rectified at sea. Interestingly, there is certainly one casualty that occurred whilst the vessel was at anchor.

Regarding the specific type of tonnage, there are some trends that can be identified and, perhaps surprisingly, not all vessels affected are elderly bulkers. With the dry bulk market suffering a severe downturn in recent months, fixing vessels to lift this type of cargo has become a more viable option for some owners out of necessity. A number of classes of vessel can be affected right up to panamax.

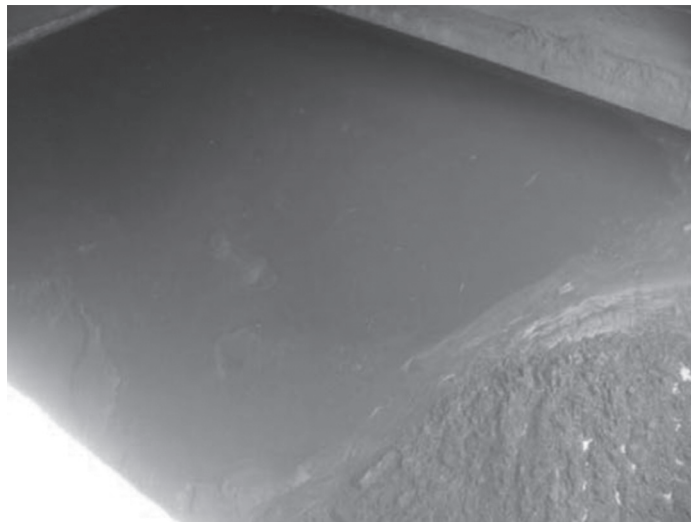
More specifically, the following casualties can be attributed to cargo liquefaction with the loss of many lives:

Vessel	Vessel Details	DOL	Loss of Life	Voyage
Mega Taurus	1988	16/12/1988	20	Hinatuan Mine (Philippines) - Japan
Oriental Angel	1990	09/06/1990	0	New Caledonia (capsized at anchorage)
Sea Prospect	1998	26/08/1998	10	Grebe island Mine (Indonesia) – Japan
Jag Raghul	2005	Dec-07	0	Tanjung Buli (Indonesia) – Ukraine (nr miss)
Asian Forest	2007	17/07/2009	0	Sank In The Arabian Sea 8 Miles Southwest Of Mangalore, India
Jian Fu Star	1983	27/10/2010	12	Sank In The South China Sea 90 Miles Southwest Of Cape Eluanbi, Taiwan
Nasco Diamond	2009	10/11/2010	20	Developed list to port, took water and sank In The Pacific Ocean.
Hong Wei	2001	03/12/2010	10	Capsized and sank in the South China Sea.
Vinalines Queen	2005	25/12/2011	22	Developed 18 degree list and eventually sank In the Philippine Sea.

In terms of trading patterns, there is a clear trend. Although the actual number is likely to be significantly higher, Intercargo are aware of at least 39 voyages of these types during 2011 typically emanating from Indonesia and the Philippines and in the case of iron ore fines, from India.

Invariably, destinations are in Asia - China imported 12.5% more nickel ore during 2011 compared to the previous year and according to Intercargo, that growth is set to increase. It is said that in time Indonesia may develop its own refining capability and that ultimately would reduce the amount of nickel ore being exported.

Whilst the inherent vulnerability of nickel ore to liquefaction is clear, it is essentially poorly controlled and regulated shore storage, testing and loading that can turn a difficult cargo into an extremely dangerous one. Loading parameters are defined within IMO's IMSBC Code and specified to prevent loading below a defined transportable moisture limit (TML) content.



*Loaded Liquefied Iron Ore Fines*

At present the implementation of these regulations is not considered consistent and may not prove effective. If a cargo is above its TML, there are no safe weather conditions for its carriage. Variables include:

- Poor or non-existent pre-loading surveys, whether cross-sectional samples taken
- Surveys should be regulated by a competent authority of the exporting state (authorities akin to the UK's MCA in their function)
- The surveyor may not be technically qualified and may not be independent of the shipper
- It is often difficult for a surveyor recognised by insurers to attend and carry out an effective survey and TML test

Nor is the marine liability market immune from this problem; the owners of the one of the vessels that is known to have suffered a casualty are in the process of recovering in excess of USD12m from vessel charterers.

#### 4. Industry Solutions?

As a representative association for dry bulk operators, Intercargo has been instrumental in successful lobbying at the IMO in order to raise the profile of the liquefaction issue and encourage more effective regulation, resulting in the launch of the IMSBC Code under SOLAS which came into force in 2011. The IMSBC Code establishes legal requirements upon the shippers and the exporting countries as well as ship owners and charterers.

The Chairmen of JHC and the Risk Assessment sub-committee have attended a number of meetings with their IGPA counterparts and Intercargo since July last year to establish how and if commercial hull underwriters could assist the cause of the wider industry.

Via the IUMI seat at IMO, JHC have added weight to the lobby that are seeking to further refine the IMSBC Code to ensure tighter control. However, practical progress towards significantly safer shipment of nickel ore and iron ore fines is likely to be slow. IUMI returned to this issue in September 2010 at their Zurich conference including a presentation during the Loss Prevention Workshop (refer attached link). This highlighted some weaknesses in the IMSBC code – simply because a cargo is not categorised as group “A” does not mean it cannot experience liquefaction. As evidenced by the recent ‘*Vinalines Queen*’ total loss, the problem remains.

The Clubs believe their joint industry approaches to the IMO would lead to a better more appropriate test, but that it will be some time before this could be implemented.

One serious difficulty is that the tests currently conducted before loading are not necessarily sufficient to pick up the potential problem. Therefore, even tests done by reputable independent organisations may not give assurance the cargo loaded is “safe.” Similarly, the test that can be performed by the ship’s personnel once loaded is not reliable. Apart from the risk to life and property from destabilisation, the highest costs and difficulties result from the necessary unloading and transhipment of a loaded cargo identified as unsafe.

##### **5. Insurance Industry Solutions?**

Whilst the issue is largely regional and direct/insurance exposure to the hull risks concerned is relatively small in the context of the London Market overall, the risk to (particularly) seafarers, vessels and the environment continues.

Any remedial action that property or liability insurers are able to take, either in terms of risk management or through a restriction in insurance coverage that assists better enforcement of regulation would be welcomed by the dry bulk industry who are seeking our support where possible.

It is clear that close assessment is required when considering a risk that may fall into this category. Assessment would include the normal criteria for dry bulk tonnage but emphasis should be placed on

- Trade patterns including ports previously visited
- specific cargoes lifted and the possibility of spot charters to carry nickel ore or iron ore fines
- ports of loading and discharge
- in the event cargoes of this nature are likely to be shipped
  - details of pre-shipment storage arrangements
  - details of which competent organisation regulates cargo loading
  - which surveyor is commissioned by the Competent Authority in order to carry out the loading and specifically the TML test, and
  - previous experience carrying nickel ore/iron ore fines cargo (there is evidence that suggests inexperience in shipping this type of interest may be a strong contributory factor)

The onus is on underwriters to satisfy themselves that the bulk carrier owners in question employ the correct procedures in order to prevent charterers and/or shippers from loading unsafe cargoes.

Since the vast majority of total losses in recent years have all been vessels owned by far eastern interests, it is fair to assume that these owners geographically pose a higher risk.

However, it must be acknowledged that there are also highly responsible owners who carry these types of cargo in a very safe and controlled manner.

SOLAS imposes clear and explicit duties on the master to safeguard his vessel and have the cargo properly tested before loading. The master should also monitor weather conditions during loading, stopping the operation at his discretion. In the absence of satisfactory risk management evidence, underwriters should seek specific details and use clear policy language that ensures the owner and his charterer are fully aware of their obligations. The JHC believe this should encourage more effective surveys for the loading of cargo types that can be extremely dangerous unless effectively regulated.

If any underwriter requires further information on this issue, please contact the chairman of either JHC or of the Risk Assessment Sub Committee:

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##### **Further Reading:**

**Intercargo** January 2011

[http://www.intercargo.org/pdf\\_public/intercargo%20news%20release%2001-11%20hazardous%20cargoes.pdf](http://www.intercargo.org/pdf_public/intercargo%20news%20release%2001-11%20hazardous%20cargoes.pdf)

**International Chamber of Shipping** September 2011

[http://www.marisec.org/icsorange/icsirculars11/CE\\_11\\_13%20-%20Cargoes%20subject%20to%20liquefaction.pdf](http://www.marisec.org/icsorange/icsirculars11/CE_11_13%20-%20Cargoes%20subject%20to%20liquefaction.pdf)

**IMO Submission by Intercargo, BIMCO, IGPA & IUMI** July 2011

[http://www.igpandi.org/downloadables/submissions/imo/DSC%2016%20Industry%20submission%20\(1\).pdf](http://www.igpandi.org/downloadables/submissions/imo/DSC%2016%20Industry%20submission%20(1).pdf)

**IUMI 2010** Presentation at the Loss Prevention Workshop

[http://www.iumi.com/images/stories/IUMI/Pictures/Conferences/Zurich2010/Wednesday/lp\\_flowmud\\_vanreterghem.pdf](http://www.iumi.com/images/stories/IUMI/Pictures/Conferences/Zurich2010/Wednesday/lp_flowmud_vanreterghem.pdf)

**North of England Briefings**, March 2010

<http://www.nepia.com/loss-prevention/publications-and-guides/loss-prevention-briefings/>

Cargo Liquefaction

Carriage of Nickel Ore