

Liquefaction

→ Members of the Hong Kong Branch gathered in April to hear Captain Paul Walton AFNI MCMS talk on the subject of IMSBC Code Group 'A' Bulk Cargoes, including the prevention, cause and effect of liquefaction.

Captain Walton gained extensive seagoing experience, including command of bulk carriers, before becoming a surveyor and consultant. During his time in the Far East he has become an authority on the problems of liquefaction, and gave us a comprehensive overview which was both fascinating and rather alarming.

The International Maritime Solid Bulk Cargo Code and Supplement covers more than 300 different cargoes divided into three groups. Group A, cargoes which may liquefy, was the main subject of the talk. The group includes mineral concentrates, nickel ore and coal slurry. Group B comprises cargoes that possess a chemical hazard such as coal, direct reduced iron, iron oxide and sodium nitrate, and it should be noted that coal can be included in both Groups A and B if 75% of the particles are less than 5mm in diameter. Group C covers cargoes which do not liquefy or pose a chemical hazard, including iron ore pellets, cement, limestone and gypsum.

Turning to casualty statistics, there were 35 bulk carrier losses between 2010 and 2013, causing the deaths of almost 100 crew members. At least seven of these losses were due to liquefaction of the cargo. In the majority of cases, those cargoes were loaded at ports in the Far East. So far this year there have been two bulk carrier losses, but they were unrelated to cargo matters and, mercifully, no crew members were killed.

Liquefaction occurs when the volume of space between particles reduces as cargo is compacted by the ship's motion. The space reduction causes an increase in water pressure, reduced friction between particles and reduced shear strength. This permits the

cargo to slide, creating free surface effect and reducing the GM (distance from the centre of gravity to the metacentric height of the ship). It cannot occur when cargo particles are small and have good cohesion so water pressure between particles does not increase, or if the cargo contains large particles which permit water to pass freely. Dry cargoes, naturally, cannot liquefy.

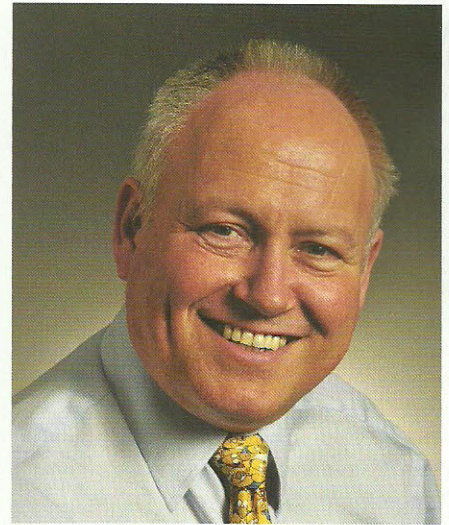
The speaker showed a series of slides representing the GZ curve of a Handymax bulk carrier loaded with 50,000mt of cargo, as successive holds suffer liquefaction. With four holds affected, the vessel was at an angle of loll of 18 degrees, and was in serious trouble.

After describing the main sources of cargo which are prone to liquefaction, Captain Walton described problems which are often seen in the affected ports:

- Loading by barge with no access to stockpiles;
- Stockpiles a great distance from the vessel;
- Remote locations where local laboratories may favour the shipper;
- Stockpiles and transport not protected from the elements;
- Shippers refusing to nominate a stockpile prior to the vessel's arrival;
- Misdeclaration;
- Local surveyors not fully conversant with sampling requirements.

He went on to describe proper sampling procedures in accordance with Section 4 of the IMSBC Code. His hypothetical cargo of 50,000mt would require 200 sub-samples to be taken to form the representative sample, which is tested to determine moisture content, flow moisture point and transportable moisture limit.

After describing the most common testing methods, the speaker gave some interesting examples of inaccurate cargo declarations, and how they were detected. He also showed a number of photographs of cargoes whose



Captain Paul Walton AFNI

appearance gave some classic early warning signs of high moisture content. Even when such signs are not readily apparent, the prudent Master will conduct a can test on arrival and throughout the loading operation.

Captain Walton believes good bulk carrier operators should provide their crews with the following publications as a minimum:

- IMSBC Code 2012 and Supplement;
- IMDG Code 2010 Vols 1 and 2 with Supplement;
- Flag and Class advisories;
- P&I Club Loss Prevention Bulletins;
- The NI publications *Bulk Carrier Practice* and *Hatch Cover Inspections*;
- Thomas's *Stowage*;
- The commercial publications *Bulk Carrier Notes* and *Cargo Notes*.

The presentation concluded with a description of the 2013 amendments to the IMSBC Code, and a lively question and answer session.