Introduction

Self-heating incidents involving coal cargoes loaded at Indonesian ports have become increasingly frequent in recent years. The problem appears to be primarily related to the nature of the coals, and may be exacerbated by the way they are handled prior to and during loading.

Recommendations for the safe carriage of coal are contained in Appendix 1 of the IMSBC Code (the Code), which became mandatory worldwide on 1 January 2011. This checklist is intended as an '*aide memoire*' for the guidance of shippers, shipowners, charterers, surveyors, ships' crews and other parties involved in the loading and carriage of cargoes of coal. It is not intended as a substitute for the full recommendations as presented in the Code and rather considers the potential hazard of self heating. The Code of Safe Practice for the Safe Loading and Unloading of Bulk Carriers is included as a supplement in the IMSBC Code.

Nature of the hazard

The schedule in Appendix 1 of the Code refers to the Bulk Cargo Shipping Name (BCSN) "COAL (bituminous and anthracite)". As material hazardous in bulk (MHB) it is placed in Group B (and A). Group B cargoes possess a chemical hazard; coal may create flammable atmospheres, may heat spontaneously, may deplete the oxygen concentration and may corrode metal structures. When the cargo oxidises (generating heat) it releases the toxic gas carbon monoxide. Group A cargoes are defined as those which may liquefy if shipped at moisture contents in excess of their transportable moisture limit (TML). Procedures and precautions for safe shipment are described in the appendix to the schedule in the Code.

Coal shipped from Indonesia is likely to contain a significant proportion of lower-rank coals in the sub-bituminous and lignite (brown coal) categories. In general terms, lower rank coals are more susceptible to self- heating than the high rank coals. They are also likely to have high moisture content, e.g. 30-40%. Brown coals tend to release more carbon monoxide into the sealed cargo holds than bituminous coals and anthracite. It should be noted that "lignite" is listed separately in the cargo schedules under the BCSN "BROWN COAL BRIQUETTES" which are manufactured by compressing dried brown coal particles into blocks. Procedures and precautions for safe shipment for brown coal briquettes are described in the appendix to the schedule in the Code.

Shippers' descriptions of the cargo, e.g. "steam non-coking coal in bulk", may not reflect the nature and properties of the coal being presented for shipment. The general provisions of the IMSBC Code state that where a bulk cargo is specifically listed in Appendix 1 (the schedules) it should be carried in accordance with the provisions in the schedule. If the cargo is not specifically listed (by BCSN) in the Code the master is referred to sections 1.3 and 1.5 of the IMSBC Code which details the procedures a shipper must follow with the competent authorities (of the ports of loading, discharge and flag state) to provide a certificate stating the characteristics of the cargo and the required conditions for handling.

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How to monitor coal cargoes from Indonesia

A checklist to help reduce the risk of self-heating in Indonesian coal cargoes

Checklist

Prior to loading

Documentation (IMSBC Code section 4)

- shipper to supply complete documentation relating to the cargo identified by BCSN as *required* by the Code (secondary names may be used in addition)
- coal must be declared as either Group B or as Group A and B
- check that shipper has not used outdated classifications such as "Category A" when describing the cargo
- if the shipper declares a value for the TML (Group A cargo) check that additional certification as *required* by the Code is supplied including recent (less than 7 days) representative cargo moisture content analysis
- consider all coal loaded in Indonesia as having the potential to self-heat, irrespective of the wording of the shipper's declaration.

Hold preparation (IMSBC COAL schedule and Appendix)

- all cargo spaces and bilge wells clean and dry
- all residues of waste material or previous cargo removed
- all electrical cables and components in cargo spaces and adjacent enclosed spaces free from defects. Such cables and components to be safe for use in an explosive atmosphere or positively isolated.

Vessel instrumentation

- equipment to measure methane, oxygen and carbon monoxide in the hold atmospheres without entering the cargo space
- equipment to measure pH value of cargo space bilge samples
- it is recommended that a means of measuring the temperature of the cargo whilst it is being loaded and during the voyage is available. (Infared thermometers are an invaluable addition to standard thermometers in this regard but only measure the surface temperature. Probes can typically measure at depths up to 1m below the surface).

Temperature monitoring

- temperature of the cargo to be monitored prior to loading. Look for 'hot spots'
- any cargo at a temperature in excess of 55°C should not be loaded
- note that coal cargoes delivered to anchorage in barges may be particularly susceptible to self- heating as they are exposed to the wind
- shippers and surveyors may quote an 'average temperature' measurement in relation to a barge cargo in order to establish a value below 55°C. The Code does not recognise this methodology.

During loading

Temperature monitoring

- monitor the temperature of the cargo regularly during loading, not just when the first barge arrives. The cargo is likely to be hotter towards the bottom of the stow in the barge
- reject any cargo at a temperature in excess of 55°C
- do not stow cargo adjacent to hot areas.

Ingress of air

- employ 'soft loading' as much as is possible
- as cargo in partially filled holds will be exposed to ingress of air, avoid undue delays when loading
- if delays occur, close partially filled holds and do not ventilate.

After loading

Trimming

- trim the cargo as level as possible to the boundaries of the cargo spaces
- shippers may resist requests to properly trim, insist that they do so.

Cargo monitoring

- close and seal the holds immediately after loading in accordance with the Code recommendations for self-heating coals
- begin monitoring of the hold atmospheres for methane, carbon monoxide and oxygen immediately, recording the results and the time they were obtained
- gas monitoring to be done through proper fittings in the holds as described in the Code, not through open accesses or covers.

During the voyage

Cargo monitoring

- monitor the hold atmospheres for methane, carbon monoxide and oxygen at least once a day; more frequently if the carbon monoxide and/or methane concentrations begin to rise steadily. Maintain a proper record of these measurements
- a reduction of the oxygen concentration in a well sealed hold is to be expected
- below an oxygen concentration of about 10%, most instruments in common use will not provide reliable readings of the methane %LEL. (Check your instrument manufacturer's recommendations on the use of a 'splitter' at low oxygen levels and/or seek expert advice if there is cause for concern)
- temperatures measured by lowering thermometers into sounding pipes may be useful in general terms but should not be relied upon to reflect any changes occurring in the bulk of the cargo as temperature monitoring via sounding pipes will only detect heating coal in the immediate vicinity and will not provide information on the bulk of the cargo
- if methane in excess of 20% of the LEL is detected use surface ventilation in accordance with the Code but *only* for the *minimum time necessary* to remove the methane. If this concentration of methane is detected after the oxygen has fallen below 10% seek expert advice before ventilating
- if carbon monoxide concentration in a closed cargo hold exceeds 30ppm the Code recommends that the frequency of measurement is increased to twice daily. If the carbon monoxide exceeds 50ppm the Code recommends the owner should be notified to call for expert advice. With Indonesian coal the carbon monoxide level can be significantly higher than these values without indicating the presence of self heating but the owner should still be notified (in accordance with the Code) particularly if the gas concentration continues to rise steadily over a period of three consecutive days.

Note
Recommendations for the cargo space gas monitoring procedure are contained within the Code and the carriage of coal is described in the in UK P&I Club publication *Carefully to Carry* - Coal cargoes.