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Coal cargoes: self-heating and monitoring of evolved gas

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Club Inspectors have recently come across instances where ships' crew are not familiar with, or have little knowledge of, the recommendations of the IMO *Code of Safe Practice for Solid Bulk Cargoes* (BC Code), with particular reference to monitoring and measuring gases associated with the carriage of coal. These gases include Carbon Monoxide (CO), Methane (CH_4) and Oxygen (O_2).

The Inspectors have also recently seen numerous ships where the new copy of the BC Code (2001) has not been placed onboard.

The following is the relevant Appendix to the BC Code, for reference:

APPENDIX G: Procedures for gas monitoring of coal cargoes

G.1 Observations

Carbon monoxide monitoring, when conducted in accordance with the following recommendations, will provide a reliable early indication of self-heating within a coal cargo. This allows preventive action to be considered without delay. A steady rise in the level of carbon monoxide detected within a hold is a conclusive indication that self-heating is taking place.

All vessels engaged in the carriage of coal should carry on board instruments for measuring methane, oxygen and carbon monoxide gas concentrations (general requirements for all coals, section 3.3 in the Coal entry, Appendix B), so that the atmosphere within the cargo space may be monitored. This instrument should be regularly serviced and calibrated in accordance with the manufacturer's instructions. When properly maintained and operated, this instrument will provide reliable data about the atmosphere within the cargo space. Care needs to be exercised in interpreting methane measurements carried out in the low oxygen concentrations often found in unventilated cargo holds. The catalytic sensors normally used for the detection of methane rely on the presence of sufficient oxygen for accurate measurement. This phenomenon does not affect the measurement of carbon monoxide, or measurement of methane by infrared sensor. Further guidance may be obtained from the instrument manufacturer.

G.2 Sampling and measurement procedure

G.2.1 Equipment

An instrument is required which is capable of measuring methane, oxygen and carbon monoxide concentrations. The instrument should be fitted with an aspirator, flexible connection and a length of tubing to enable a representative sample to be obtained from within the square of the hatch. Stainless steel tubing approximately 0.5 m in length and 6 mm nominal internal diameter with an integral stainless steel threaded collar is preferred. The collar is necessary to provide an adequate seal at the sampling point.

A suitable filter should be used to protect the instrument against the ingress of moisture as recommended by the manufacturer. The presence of even a small amount of moisture will compromise the accuracy of the measurement.

Each sample point should comprise a hole of diameter approximately 12 mm positioned as near to the top of the hatch coaming as possible. It should be sealed with a screw cap to prevent ingress of water and air. It is essential that this cap is securely replaced after each measurement to maintain a tight seal.

The provision of any sample point should not compromise the seaworthiness of the vessel.

G.2.3 Measurement

Ensure that the instrument is calibrated and working properly in accordance with the manufacturer's instructions. Remove the sealing cap, insert the stainless steel tube into the sampling point and tighten the integral cap to ensure an adequate seal. Connect the instrument to the sampling tube. Draw a sample of the hold atmosphere through the tube using the aspirator, until steady readings are obtained. Log the results on a form, which records cargo hold, date and time for each measurement.

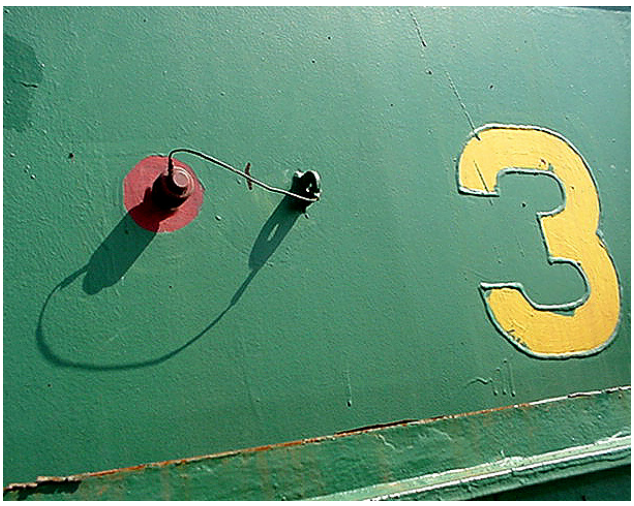
G.2.4 Measurement strategy

The identification of incipient self-heating from measurement of gas concentrations is more readily achieved under unventilated conditions. This is not always desirable because of the possibility of the accumulation of methane to dangerous concentrations. This is primarily, but not exclusively, a problem in the early stages of a voyage. Therefore it is recommended that holds are initially ventilated until measured methane concentrations are at an acceptably low level.

G.2.5 Measurement in unventilated holds

Under normal conditions one measurement per day is sufficient as a precautionary measure. However, if carbon monoxide levels are higher than 30 ppm then the frequency should be increased to at least twice a day at suitably spaced intervals. Any additional results should be logged.

If the carbon monoxide level in any hold reaches 50 ppm, self-heating conditions may be developing and the owners of the vessel should be notified.



Hold sampling point

G.2.6 Measurement in ventilated holds

If the presence of methane is such that the ventilators are required to remain open, then a different procedure should be applied to enable the onset of an incipient self-heating condition to be detected.

To obtain meaningful data, the ventilators should be closed for a period before the measurements are taken. This period may be chosen to suit the operational requirements of the vessel, but it is recommended that it is not less than four hours. It is vital in the interests of data interpretation that the shutdown time is constant whichever time period is selected. These measurements should be taken on a daily basis. If the carbon monoxide results exhibit a steady rise over three consecutive days, or exceed 50 ppm on any day, the owners of the vessel should be notified.

At least one manufacturer of gas sampling/monitoring equipment – Draeger – is offering training courses on the uses and the servicing/calibration of their instruments. The courses are run at their premises in the UK, or on-site by prior arrangement.

Sources of Information:
UK P&I Ship Inspection / Loss Prevention Department
IMO BC Code (2001)

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