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Self-heating of coal cargoes - Kalimantan, Indonesia

Burgoynes have dealt with five incidents of overheating coal off Kalimantan in the last two months, and 18 incidents in the last two years. The majority involved the loading of low rank coal in excess of 55°C. It appears that there are a number of operators off Kalimantan (Indonesian Borneo) who are shipping coal without following accepted industry good practice. Unless loading is closely monitored, the problems are usually only seen after the cargo has been loaded, and once loaded we have often experienced great difficulties in arranging the removal of the coal due to the lack of facilities in the region (i.e. availability of floating cranes and empty barges). We have encountered problem cargoes from a number of different suppliers and shippers. In this note we briefly outline the actions that can be taken by Owners and Masters to help prevent any problems escalating.

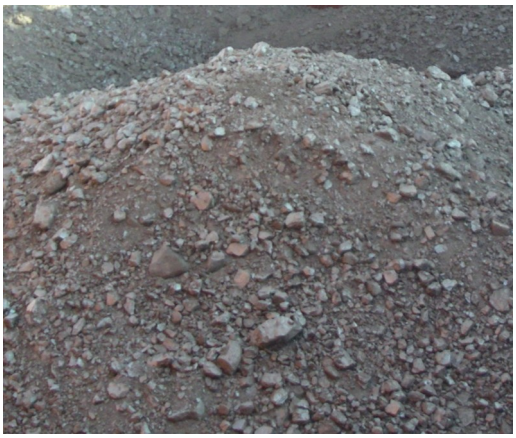
The shippers

Whilst there are many good shippers and mining operations in Kalimantan, it appears that some are not providing adequate cargo declarations. Some of the declarations misrepresent the cargo by either stating that the cargo is category A (a reference to the 1990 version of the BC Code meaning it does not self-heat or emit methane) whilst others provide no details on the self-heating or methane emitting properties of the coal. The majority of coal loaded off Kalimantan is prone to self-heating, which does not mean that it is unsafe to carry, only that precautions need to be taken. Often the shippers have barges waiting at sea, open to strong winds and rain, near to the anchorages – a situation that can often promote self-heating. When loading cargo from these barges coal temperatures in excess of 55°C are often encountered.

IMSBC Code

The IMSBC Code requires at a minimum that the shipper (or agent) provides cargo details, including:

- Moisture content.
- Sulphur content.
- Particle size.
- **Information on whether the cargo may be liable to emit methane or self-heat, or both.**



The IMSBC Code requires that the ship has:

- An instrument for measuring methane, oxygen and carbon monoxide in the holds (see our separate note on gas detectors).
- A means of measuring the pH values of cargo bilge samples.
- A means of measuring cargo temperature during loading and the voyage (recommendatory).

The ship

In order to avoid problems of self-heating during the voyage (and possibly whilst loading), care should be taken to measure the temperature of the cargo prior to loading. Although not required by the IMSBC Code, the use of a relatively inexpensive infra-red thermometer can greatly assist the crew. This allows them to 'scan' the surface of the cargo prior to and during loading and quickly inform the Master if the temperatures are of concern.

The Master should also insist that the shipper provides a cargo declaration that is consistent with the requirements of the IMSBC Code. According to the IMSBC Code, the Master should not load cargo without having received the required declaration.

The holds should be sealed if during loading there is a delay of more than an hour. On completion of loading the cargo should be trimmed and the holds should be sealed in accordance with the IMSBC Code.

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Gas Detectors

For carriage of coal, the IMSBC Code states that:

"All vessels engaged in the carriage of this cargo shall carry on board an instrument for measuring methane, oxygen and carbon monoxide gas concentrations, to enable monitoring of the atmosphere within the cargo space. The instrument shall be regularly serviced and calibrated in accordance with the manufacturer's instructions."

Many portable gas detectors are multigas detectors and they can detect a range of gases – flammable, oxygen, carbon monoxide and often hydrogen sulphide. The most common type of multigas detectors use electrocatalytic detectors which function on the relatively simple and reliable principle that a combustible gas can be oxidized to produce heat. They are often used as personal safety monitors prior to entry into confined spaces to alert if toxic gas is present, or if the oxygen concentration is too low. They are also appropriate for use on board a vessel, as long as they are serviced and calibrated in accordance with manufacturer's instructions.

Poisoning and contamination of the sensors

Various substances can act as catalyst poisons. These include silicones and silicon compounds including silanes, halogens, halogenated hydrocarbons, sulphur compounds, strong acids, bases, and heavy metals. Poisoning of the catalytic element is the result of the strong adsorption of the poison on the sensor's active sites, which results in reduced sensor output in response to the presence of a combustible gas. Contamination of the sensor can be caused by a variety of factors, depending on the environment in which the sensor is used. If the sensor is exposed to particulate matter or a marine environment, its performance can be degraded by deposits. During normal maintenance of the system, an increase in the response time to calibration gas, an increase in recovery time after exposure, or a loss of sensitivity, may indicate contamination.

In all cases, poisoning the catalyst and contamination of the sensor will reduce its sensitivity. The only reliable means of identifying detector sensitivity loss is by calibration. When a sensor is used in an area known to contain potential poisons, it should be gas-checked at regular intervals and calibrated if necessary.

Flammable atmospheres

In most gas detection instruments the mechanism by which levels of flammable gas is determined depend on the presence of oxygen. At reduced oxygen concentrations the readings become unreliable. Most commonly available instruments are capable of producing reliable results down to 15% oxygen and some will work satisfactorily down to 10% oxygen. Any readings taken in oxygen concentrations below 10%, therefore, should be regarded as unreliable.

General rules for gas detector use

- **Before officers and crew use a gas detector they should be trained in its use.**
- **The instrument should be calibrated in accordance with manufacturer's instructions – this will usually require the ship to have a cylinder of calibration gas on board.**
- **The operator should switch on the gas detector and note the readings in a gas-free area, before entering a hazardous area or taking hold measurements.**
- **For measuring hold atmospheres a manual or automatic pump with a dust/water filter should always be used.**
- **Below 10% oxygen the flammable gas readings cannot be relied upon.**
- **When used to check the atmosphere in holds loaded with coal (or other cargo) the holds should have been sealed for at least 4 hours.**
- **If the gas readings appear inconsistent then the instrument should be recalibrated**

Burgoynes is an international firm of consulting scientists and engineers with extensive expertise in the investigation of a wide range of marine incidents over the last 40 years, including problem cargoes. We have offices in USA, United Kingdom, Singapore and Hong Kong.

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