

LP BULLETIN

Friday 25 July 2008

Bulletin 592 - 7/08 - Case study: improper use of fumigant in bulk cargoes - Worldwide

Members shipping dry bulk cargoes are alerted to a recent Transport Safety Investigation Report, issued by the Australian Transport Safety Bureau, into a cargo fire caused by the improper application of fumigant to the cargo.

The ship was loading a bulk cargo of palm kernel expeller (PKE), listed in the IMO BC Code as non-hazardous seed cake. Before the cargo hold hatch covers were closed, a fumigation contractor added fumigant to each hold at a rate of two grams of phosphine per cubic metre of cargo.

The plan was to place socks containing aluminium phosphide tablets on the surface of each cargo hold. However, it was raining so the contractor advised the master that the fumigant should not be placed in the cargo holds while it was raining. He outlined how the moisture from the rain could cause the fumigant to react more quickly, possibly causing it to ignite. However, the master instructed the contractor to carry out the task immediately so that the ship's departure was not delayed. As a result, the contractor buried the fumigant in the cargo in an attempt to protect it from the rain.

The cargo hold hatch covers and ventilators were then closed and sealed. The next day the crew observed black smoke coming from one of the cargo holds.

When the hold was opened, it was apparent that only two small areas of the cargo had been affected. Both of the affected areas had burnt in a circular pattern that was centred on the location of a fumigation sock. However, the fires had not grown in size over the ensuing days because as they developed they had consumed the available oxygen in the cargo hold.

Ignition source

The fumigant tablets (aluminium phosphide) react with moisture in the atmosphere to release phosphine gas. Heat and diphosphine gas are also generated as a result of the reaction. As the temperature and humidity in the atmosphere increases, the rate at which the gases are released also increases with the reaction producing further heat.

Localised high concentrations of phosphine and diphosphine gases are likely if the reaction occurs too quickly, if too much fumigant is placed in the packaging, or if the packaging does not allow the gases to escape quickly enough.

Furthermore, there will be a localised increase in temperature if the heat produced as a result of the reaction is slow to dissipate.

Pure phosphine gas has an auto-ignition⁴ temperature greater than 100°C. However, diphosphine gas has an auto-ignition temperature of about 90 to 100°C.

The socks containing the fumigant were buried in the cargo. The



surrounding cargo would have slowed the dissipation of heat from the reacting fumigant tablets. As a result, it is likely that the local temperature rose to a level above the auto-ignition temperature of the diphosphine gas and that the gas subsequently ignited.

Furthermore, it is possible that the local concentrations of the gases built up quickly as a result of the hot and humid conditions inside the cargo hold and that there may have also been too much fumigant placed in each sock.

The fumigation

The contractor who carried out the fumigation provided the master with documentation that named the fumigant, defined the dosage rate, outlined the fumigation plan and the safety precautions to be followed during the voyage and when the cargo holds were to be ventilated.

However, the contractor did not supply the master with information regarding all of the hazards associated with the use of the fumigant, or instructions outlining the correct method for its application.

It is fair for a ship's master to expect that a fumigation contractor is an expert in the field and, therefore, should carry out the task correctly and supply the ship with sufficient information to allow the crew to effectively supervise the process. However, the master and the ship's crew should also heed the contractor's advice – in this case that the fumigant should not be placed in the cargo holds while it was raining.

The ATSB advises that the relevant organisations consider the safety implications discussed in the report. It advises the relevant organisations to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices. Use the following link to view the full text of the report on the ATSB website: http://www.atsb.gov.au/publications/investigation_reports/2008/MAIR/mair250.aspx



Images (clockwise from top left):

1. Fumigant buried in the cargo with only the top part of the sock exposed
2. The fire affected areas of the cargo
3. The cargo on the wharf being hosed.

Source of information: Australian Transport Safety Bureau (ATSB)