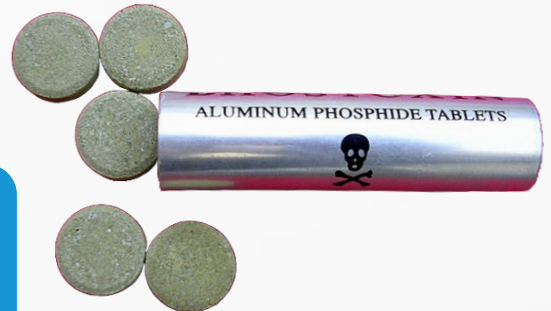


CARGO FUMIGATION BY PHOSPHINE GAS

IVR
Technical leaflet

FUMIGATION:

The process of releasing toxic gasses into a cargo hold or compartment for the purpose of eliminating or avoiding infestation by live insects or other pests that may cause cargo deterioration.



PHOSPHINE GAS:



The most commonly used fumigant is phosphine gas, a gas that is also very toxic for humans. The European Indicative Occupational Exposure Limit (IOEL) Time Weighted Average (TWA) is 0.1 ppm, and the Short Term Exposure Limit (STEL) is 0.2 ppm. Symptoms have been reported in workers exposed intermittently to concentrations up to 35 ppm, and 290 to 430 ppm would be dangerous to life after 1 hour.

OEL TWA:

Time-weighted average concentration for a conventional 8-hour working day and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, for a working lifetime without adverse effect.

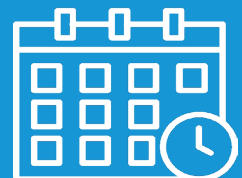
OEL STEL:

15-minute time-weighted average of the airborne concentration of a chemical substance unless otherwise stated. It should not be exceeded at any time even though the 8-hour time-weighted average exposure is within the OEL TWA. Exposures above the OEL TWA up to OEL STEL should not be more than 15 minutes and no more than 4 times a day. A minimum of 60 minutes should be allowed between successive exposures in this range.

IN-TRANSIT FUMIGATION:

Phosphine is only fully effective if a lethal concentration is maintained for a period of time between 3 days and 3 weeks. This is the time needed for the gas to penetrate throughout the entire cargo heap. This period depends on the dimensions of the cargo heap, temperature and moisture and is to be assessed upon application by a professional.

Because of the time needed, in-transit fumigation is preferred by shippers and charterers because it reduces time in port. In-transit fumigation is done on board of sea-going ships, but it is also observed on rail-cars and even trucks arriving from Eastern Europe.



CARGO FUMIGATION BY PHOSPHINE GAS

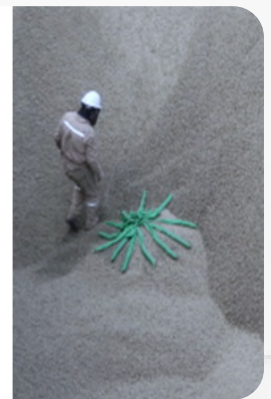
RISK FOR INLAND SHIPPING:

Phosphine is not applied directly as a gas, but most commonly in the form of aluminium phosphide tablets or pellets. These tablets react with moisture, to form phosphine gas and aluminium oxide or aluminium hydroxide. As long as the tablets are not fully dissolved, they keep producing toxic gasses.

All phosphine tablets should be dissolved before loading foodstock or grain into a barge.

Where tablets are allowed to be used in-transit, they should be packed in sleeves so that any remnants can be easily removed before discharge.

The ship's/railcars/trucks holds should be tested by a professional (a so-called gas doctor) before and during discharge, and not be released if not safe.



AWARENESS:

The only way to detect and measure phosphine gas is with a dedicated meter:



When in any doubt, call in a professional gas doctor.

When receiving a bulk commodity that could have been fumigated, always specifically ask if it has been fumigated recently.

Be aware of danger when you see remnants of tablets, pellets or sleeves in the cargo.

Realise that the gas can penetrate from the cargo hold into the accommodation or engine room. A cargo hold is not gas tight.

Be aware of the early symptoms of phosphine poisoning: headache, dizziness, nausea, vomiting, diarrhea, drowsiness, cough and/or chest tightness. Realise that some of these symptoms might be easily underestimated as not life-threatening.

Also pay attention to pets: they are often affected sooner than humans.

There is no antidote for phosphine toxicity. Initial treatment is ensuring that the patient is removed from the source of exposure. If this is done soon enough, it is well possible that there are no permanent negative health effects. If not, it can possibly lead to death.

When exposed, always seek medical assistance.

DISCLAIMER

The content of this technical leaflet has been written with the utmost care. However, IVR cannot guarantee the accuracy or completeness of the information. IVR accepts no liability for any consequences arising from the content of this technical leaflet. The information in this technical leaflet has been developed in collaboration with Van Ameyde Marine and the Dutch Ministry of Infrastructure and Water Management