

PHOSPHINE



Multilateral Fund
for the Implementation of the Montreal Protocol

Project MP/ZAM/08/002
Technical assistance for
the total phase-out of
methyl bromide in cut
flowers, horticulture and
post harvest use

Phosphine is used in controlling pests in enclosed space containing stored raw agricultural commodities, processed foods, stored tobacco, animal feeds and non-food products.

Phosphine is a fumigant used to protect stored commodities from damage by insects. Phosphine kills the larvae and adults of most insects quite rapidly and at low concentrations. However, the eggs and pupae require considerably more time to kill, and may not be killed using short exposures - even with higher concentrations of fumigant.

The key to effective fumigation with phosphine depends on holding the gas inside the fumigation enclosure long enough to allow the more tolerant eggs and pupae to develop into susceptible larvae and adults so that they can be killed.

Fumigation with phosphine is slow and may and temperature dependent, with shorter exposures required at higher temperatures. It is impossible to decrease this treatment period substantially (to less than 4 days at >25°C), even with increased dosage, and still obtain complete control of tolerant pests.

Because long exposure periods are required, enclosures for phosphine must be well sealed to minimise gas loss caused by leakage.

A very important feature of phosphine, not common with other fumigants, is the potential for insect pests to rapidly *develop resistance* to the fumigant. Fumigations with phosphine must be carried out to give a very high level of effectiveness to avoid providing the conditions that lead to the development and enhancement of resistance.

Phosphine *must not be used* in unsealed enclosures, when commodity temperatures are below 15°C and where there is no qualified and properly protected fumigation team.

COMMODITIES

Phosphine can be used for the fumigation of the following stored products:

- Raw agricultural commodities (cocoa beans, coffee beans, dates, peanuts, wheat, rice..)
- Processed foods (sugar, cereal flours, cereals foods, dried fruits, chocolate..)
- Animal feed and feed ingredients
- Non-food commodities (tobacco, paper, leather, cotton, wool, clothing..)
- Seeds

PESTS CONTROLLED

Insects

Cigarette beetle, Cereal leaf beetle, Dried fruit beetle, Fruits flies, Khapra beetle, Tobacco moth, Yellow meal worm, Dermestid beetle, Rice weevil and others.

Nematodes

Pine wood nematode and other wood-infesting nematodes.

Rodents and other vertebrate pests

- **Danger-Poison**
- **Flammable**
- May be fatal if inhaled
- Avoid contact with skin and eyes and avoid breathing vapour
- Keep children, animals and unauthorized persons away from area under treatment
- Phosphine may ignite spontaneously at concentrations of 27.3 g/m³ in air (commercial solid formulations contain substances that reduce the fire hazards)
- Exposure to temperatures above 100°C at high concentrations and at reduced pressures may cause bursting
- Phosphine reacts with copper and copper-containing alloys such as brass, and with precious metals (silver, gold), corroding them.



NOTE: Always refer to the Material Safety Data Sheet (MSDS) supplied by the manufacturer for further specifications and advice.

Fumigation with Phosphine

STRUCTURES

Phosphine fumigants can be used in a variety of structures including grain bins and silos and flat storage structures.

The structure must be sealed.

EXPOSURE PERIOD

- 7-10 days at temperatures above 25°C

- 14 days at temperatures between 15-20°C

DOSAGE

To choose the correct dosage read the manufacturer's label. Dosage depends on the volume of space to be fumigated, on temperature and on moisture content of the commodity.

Application Technique

Phosphine may be supplied in metal phosphide formulations (tablets, pellets, sachets, plates), as a compressed gas in cylinders or from generators (machines that allow phosphine to be released at a controlled rate from formulations of aluminium phosphide).

An effective fumigation requires that the phosphine gas be held in the infested structure long enough to kill the target pests. After fumigation, the gas must be vented to the legal level for human exposure.

PREPARATION FOR FUMIGATION

Preparation includes site inspection, planning and risk assessment, definition of risk area (area surrounding the fumigation enclosure into which a fumigant gas may escape), placing warning notices.

The risk area must be clearly marked in accordance with national or local government regulations.

SEALING OF FUMIGATION ENCLOSURES

Fumigation enclosures should be sealed to an acceptable / standard level of gas tightness that guarantees effective fumigation with phosphine. Temporary enclosures are most commonly made by covering bag-stacks and freight containers under plastic sheets.



APPLICATION OF METAL PHOSPHIDE PREPARATIONS

All fumigators involved in application of solid fumigant-generating formulations shall carry a full face respirator equipped with a working and effective filter canister for phosphine when inside the work area and they shall be ready for use it in the event of an emergency.

Tablet or pellet preparations should be applied to sheeted containers or bag stacks before they are sealed completely.



MONITORING FUMIGANT CONCENTRATIONS

Gas concentration should be measured before, during and at the end of exposure period to know if the target concentration has been achieved and to check if the fumigation enclosure is leaking.

OPENING THE FUMIGATION ENCLOSURE

At the conclusion of the exposure period fumigation enclosure should be open and minimum period of ventilation should be observed (1-4 days depending on the size of the structure and of presence of low-through ventilation).

POST TREATMENT ACTIONS

A written record of each fumigation should be maintained, including an assessment of effectiveness of fumigation.

Fumigation can be ineffective:

- in case of leaking,
- for incorrect dosage,
- at temperatures below 15°C.