



APPLICATOR'S MANUAL
FOR

**DEGESCH PHOSTOXIN® PELLETS AND
DEGESCH PHOSTOXIN® TABLETS**

FOR CONTROL OF INSECTS IN STORED GRAIN,
PROCESSED FOODS, FEEDS AND NON-FOOD COMMODITIES, INCLUDING TOBACCO

READ THE ENTIRE LABEL, APPLICATOR'S MANUAL AND GUIDANCE FOR PREPARATION OF A FUMIGATION
MANAGEMENT PLAN BEFORE USING.

THIS PRODUCT CAN ONLY BE USED IN CONJUNCTION WITH A DETAILED FUMIGATION MANAGEMENT PLAN

RESTRICTED

DANGER



POISON

KEEP OUT OF REACH OF CHILDREN

GUARANTEE: Aluminum Phosphide 55%

REGISTRATION NO. 15735 PEST CONTROL PRODUCTS ACT (Pellets)

OR

REGISTRATION NO. 15736 PEST CONTROL PRODUCTS ACT (Round Tablets)

Manufactured for:

DEGESCH AMERICA, INC.
153 TRIANGLE DRIVE
P. O. BOX 116
WEYERS CAVE, VA 24486 USA
EPA Est. Nos. 40285-VA-01
33982-WG-1
TELEPHONE: 540-234-9281/1-800-330-2525
FAX: 540-234-8225
Internet: www.degeschamerica.com
E-Mail: degesch@degeschamerica.com

Canadian Agent:

GARDEX CHEMICALS LTD.
7 MERIDIAN ROAD
ETOBICOKE, ONTARIO
CANADA M9W 4Z6
TELEPHONE: 416-675-1638
FAX: 416-798-1647

THIS PRODUCT IS ACCOMPANIED BY AN APPROVED LABEL AND APPLICATOR'S MANUAL. READ AND UNDERSTAND THE ENTIRE LABEL AND MANUAL. ALL PARTS OF THE LABEL AND MANUAL ARE EQUALLY IMPORTANT FOR SAFE AND EFFECTIVE USE OF THIS PRODUCT. CALL THE MANUFACTURER IF YOU HAVE ANY QUESTIONS OR DO NOT UNDERSTAND ANY PART OF THIS LABELLING.

REFER TO THIS APPLICATOR'S MANUAL FOR DETAILED PRECAUTIONS, RECOMMENDATIONS AND DIRECTIONS FOR USE.

ALUMINUM PHOSPHIDE PELLETS AND TABLETS ARE NONCOMBUSTIBLE, BUT EXPOSURE TO MOIST AIR OR WATER RELEASES FLAMMABLE AND TOXIC PHOSPHINE (HYDROGEN PHOSPHIDE) GAS. SPONTANEOUS IGNITION MAY RESULT IF CONTACTED BY WATER, ACIDS, OR OTHER LIQUIDS.

HYDROGEN PHOSPHIDE-AIR MIXTURES AT CONCENTRATIONS ABOVE THE LOWER FLAMMABLE LIMIT MAY IGNITE SPONTANEOUSLY. IGNITION OF HIGH CONCENTRATIONS OF HYDROGEN PHOSPHIDE CAN PRODUCE A VERY ENERGETIC REACTION. EXPLOSIONS CAN OCCUR UNDER THESE CONDITIONS AND MAY CAUSE SEVERE PERSONAL INJURY. **NEVER ALLOW THE BUILD-UP OF HYDROGEN PHOSPHIDE TO EXCEED EXPLOSIVE CONDITIONS.** DO NOT CONFINE SPENT OR PARTIALLY SPENT DUST FROM METAL PHOSPHIDE FUMIGANTS, AS THE SLOW RELEASE OF HYDROGEN PHOSPHIDE FROM THIS MATERIAL MAY RESULT IN THE FORMATION OF AN EXPLOSIVE ATMOSPHERE.

NOTICE TO USER: This pest control product is to be used only in accordance with the directions on the label. It is an offence under the *Pest Control Products Act* to use this product in any way that is inconsistent with the directions on the label. The user assumes the risk to persons or property that arises from any such use of this product.

NATURE OF RESTRICTIONS: This product is for retail sale to and use only by appropriately provincially licensed persons for those uses covered by the applicator's certification or persons trained in accordance with the Applicator's Manual working under the direct supervision and in the physical presence of the certified applicator. Consult local pesticide regulatory authorities about use permits which may be required. This product must be stored away from lodging for humans, animal quarters and normal work areas to avoid inadvertent exposure.

RESTRICTED USES: For the treatment of space, grain pests in stored barley, cocoa beans, coffee beans, corn, cotton seeds, dates, dried peas, lentils, millet, nuts in shells, oats, peanuts, popcorn, rice, rye, sorghum, soybeans, sunflower seeds, triticale, wheat, all processed foods and feeds. Phostoxin® may also be used to fumigate bagged, packaged or treated cereal, grass, sorghum or small legume seeds destined for planting use only. Even distribution throughout the commodity is essential for good results. Refer to the Applicator's Manual for detailed Precautions, Recommendations and Directions for Use.

The time of required exposure is as follows:

Below 5°C	Do not fumigate
at 5-12°C	10 days are required
at 13-15°C	5 days are required
at 16-20°C	4 days are required
above 20°C	not less than 3 days

To guarantee compliance with tolerances for hydrogen phosphide residues, commodities must be aerated for 48 hours prior to offering them to the end consumer. For tobacco, aeration on hogsheads should be not less than three days; on any other type of storage, two days.

Phosphine gas may be hazardous to birds nesting on or near warehouses. Carefully inspect the outside of the structure prior to application of the fumigant to ensure the absence of nesting birds.

This product is not to be used for vacuum fumigations.

Phosphine will corrode certain metals, especially at high concentrations and humidities. Protection or removal of wiring, sensitive equipment or precious metals is recommended under these conditions.

TABLE OF CONTENTS

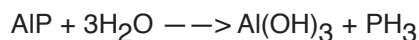
1.	INTRODUCTION	1
	SAFETY RECOMMENDATIONS SUMMARY	2
2.	FIRST AID	2
3.	TOXICOLOGICAL INFORMATION	3
4.	PRECAUTIONS	4
4.1	DANGER: Hazardous to Humans, Domestic Animals and Nesting Birds	4
4.2	Physical and Chemical Hazards	4
4.3	Environmental Hazards	5
5.	PROTECTIVE CLOTHING	5
6.	RESPIRATORY PROTECTION	5
6.1	When Respiratory Protection Must Be Worn	5
6.2	Permissible Gas Concentration Ranges for Respiratory Protection Devices	6
6.3	Requirements for Availability of Respiratory Protection for outside applications	6
7.	APPLICATOR AND WORKER EXPOSURE	6
7.1	Hydrogen Phosphide Exposure Limits	6
7.2	Application of Fumigant	6
7.3	Leakage from Fumigated Sites	6
7.4	Aeration and Reentry	7
7.5	Handling Un-Aerated Commodities	7
7.6	Industrial Hygiene Monitoring	7
8.	PLACARDING OF FUMIGATED AREAS	8
9.	FUMIGATION MANAGEMENT PLAN	8
10.	DIRECTIONS FOR USE	13
10.1	General	13
10.2	Pests Controlled	15
10.3	Exposure Conditions	16
10.4	Commodities Which May be Fumigated with Phostoxin®	17
10.5	Recommended Dosages	17
10.6	Application Procedures	18
10.6.1	General Statement	18
10.6.2	Fumigation of Mills, Food Processing Plants and Warehouses	19
10.6.3	Fumigation of Vertical Storages (concrete upright bins and other silos in which grain can be rapidly transferred)	20
10.6.4	Fumigation of Flat Storages (Flat Houses)	21
10.6.5	Fumigation of Grain Bins	21
10.6.6	Bunker and Tarpaulin Fumigations	22
10.6.7	Fumigation of Railcars, Containers, Trucks, Vans and Other Transport Vehicles	23
10.6.8	Fumigation of Ships	24
10.6.8.1	General Information	24
10.6.8.2	Pre-Voyage Fumigation Procedures	24
10.6.8.3	Application Procedures for Bulk Dry Cargo Vessels and Tankers	26

	10.6.8.4 In Transit Fumigation of Containers Aboard Ships	26
	10.6.8.5 Precautions and Procedures During Voyage	26
	10.6.8.6 Precautions and Procedures During Discharge	26
	10.6.9 Fumigations in Small Sealable Enclosures	27
11.	AERATION OF FUMIGATED COMMODITIES	27
	11.1 Foods and Feeds	27
	11.2 Tobacco	27
12.	STORAGE INSTRUCTIONS	27
13.	DISPOSAL	27
	13.1 General	27
	13.2 Product Container Disposal	28
	13.3 Disposal of Spent Residual Dust from Phostoxin®	28
	13.4 Deactivation of Partially-Spent Residual Dust from Phostoxin®	28
14.	SPILL AND LEAK PROCEDURES	29
	14.1 General Precautions and Directions	29
	14.2 Deactivation of Phostoxin® by the Wet Method	30

1. INTRODUCTION

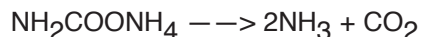
Aluminum phosphide fumigants are used to protect stored commodities from damage by insects. Fumigation of stored products with Phostoxin® in the manner prescribed in the labeling does not contaminate the marketed commodity.

Aluminum phosphide and other metal phosphide fumigants are acted upon by atmospheric moisture to produce hydrogen phosphide (phosphine, PH₃) gas. Phostoxin® tablets and pellets contain aluminum phosphide (AIP) as their active ingredient and will liberate hydrogen phosphide via the following chemical reaction:



Hydrogen phosphide gas is highly toxic to insects, humans and other forms of animal life. In addition to its toxic properties, the gas will corrode certain metals and may ignite spontaneously in air at concentrations above its lower flammable limit of 1.8% (v/v). These hazards will be described in greater detail later on in this Applicator's Manual.

Phostoxin® also contains ammonium carbamate which liberates ammonia and carbon dioxide as follows:



These gases are essentially nonflammable and act as inerting agents to reduce fire hazards. The ammonia gas also serves as a warning agent.

Phostoxin® is prepared in two spherical shapes. The rounded tablets weigh approximately 3 grams and release 1 gram of hydrogen phosphide gas. They are about 16mm in diameter and are bulk packaged in resealable aluminum flasks containing 100, 333, or 500 tablets each. The pellets weigh approximately 0.6 gram and release 0.2 gram of hydrogen phosphide gas. They are about 10mm in diameter and are also packaged in resealable flasks containing about 1666 or 2500 pellets.

Upon exposure to air, aluminum phosphide tablets and pellets begin to react with atmospheric moisture to produce small quantities of hydrogen phosphide gas. This reaction starts slowly, gradually accelerates and then tapers off again as the aluminum phosphide is spent. Phostoxin® pellets react somewhat faster than do the tablets. The rates of decomposition of the tablets and pellets will vary depending upon moisture and temperature conditions. For example, when moisture and temperature of the fumigated commodity are high, decomposition of Phostoxin® may be complete in less than 3 days. At lower ambient temperatures and relative humidity levels, however, decomposition of Phostoxin® may require 5 days or more. After decomposition, Phostoxin® leaves a grey-white powder composed almost entirely of aluminum hydroxide. This will cause no problems if the fumigant has been added directly to a commodity such as grain or bulk animal feed. However, the spent powder must usually be retrieved for disposal after space fumigations. If properly exposed, the spent Phostoxin® will normally contain only a small amount of unreacted aluminum phosphide and may be disposed of without hazard. While not considered a hazardous waste, partially spent residual from incompletely exposed Phostoxin® may require special care. Precautions and instructions for further deactivation and disposal will be given later in this Manual.

Phostoxin® tablets and pellets are supplied in gas-tight containers and their shelf life is unlimited as long as the packaging remains intact. Once opened for fumigation, the aluminum flasks of tablets or pellets may be tightly resealed and stored for future use. Storage and handling instructions will be given in detail later in the Applicators Manual.

A summary of safety recommendations is outlined below:

SAFETY RECOMMENDATIONS SUMMARY

1. Carefully read the labelling and follow instructions explicitly.
2. Never fumigate alone from inside the storage structure. At least two persons, a certified applicator and trained person, or two trained persons under the direct supervision of the certified applicator must be present during fumigation of structures when entry into the structure for application of the fumigant is required.
3. At least two persons, a certified applicator and trained person, or two trained persons under the direct supervision of a certified applicator, must be present and must wear the proper safety equipment when a structure that is under fumigation is to be entered. Observe all Provincial pesticide legislation requirements.
4. The certified applicator must maintain visual and/or voice contact with all fumigation workers during the application of the fumigants.
5. Wear dry gloves of cotton or other breathable material if contact with Phostoxin® tablets, pellets or dust is likely. Aerate used gloves and other contaminated clothing in a well ventilated area prior to laundering. Wash hands thoroughly after using Phostoxin®.
6. Never open fumigant containers in a flammable atmosphere. It is preferable to open them in open air, near a fan or other appropriate ventilation which will rapidly exhaust contaminated air.
7. Exposure to hydrogen phosphide must never exceed 0.1 ppm.
8. Piling of tablets, pellets or bags or the addition of liquid to the product is prohibited.
9. Dispose of empty containers and spent residual dust in a manner consistent with the label instructions.
10. Post warning placards on fumigated areas as per instructions in Section 8.
11. Prior to fumigation, notify appropriate company employees.
12. Hydrogen phosphide fumigants are **not** to be used for vacuum fumigations.
13. Fumigated areas must be aerated to 0.1 ppm hydrogen phosphide or less prior to reentry by unprotected workers.
14. Finished foods and feeds which have been fumigated with aluminum phosphide must be aerated for 48 hours prior to offering to the end consumer.
15. Transport of incompletely aerated commodities to a new site is permissible by rail or ship only, and the new storage site must be placarded if its concentration in phosphine is above 0.1 ppm. Trucks, vans, trailers and similar transport vehicles cannot be moved over public roads or highways until they are aerated and the warning placards removed. If workers must handle incompletely aerated commodity, or are indoors (e.g. an enclosed elevator head) they are to wear appropriate respiratory protection (see Respiratory Protection section).
16. Keep containers of Phostoxin® tightly closed except while removing product for application.
17. Phosphine will corrode copper and precious metals at high concentrations or humidities. Protection or removal of wiring, sensitive equipment or precious metals is recommended under these conditions.
18. Under no circumstances shall any processed food, feed or bagged commodity come into direct contact with Phostoxin® pellets, tablets or residual dust, or a raw agricultural commodity that will be used directly as a food without further processing
19. Do not use aluminum phosphide containers for any purpose other than recycling or reconditioning.
20. Preexposure screening of employees to detect impaired pulmonary function is recommended. Any employees developing this condition should be referred for medical examination.
21. Theft of products: Immediately report to the local police department thefts of metal phosphide fumigants.
22. Registrant must be informed of any incident involving the use of this product.

2. FIRST AID

Symptoms of exposure to phosphine-releasing products can include headache, dizziness, nausea, difficult breathing, vomiting, and diarrhea. In all cases of exposure, protect yourself, remove the person from the source of exposure and get them to an Emergency department. If possible, bring this Applicator's Manual, the container, label or product name and Pest Control Registration Number with you when seeking medical attention.

FIRST AID RESPONDER PROTECTION: Phosphine gas is a highly toxic systemic poison and a severe respiratory tract irritant. Persons exposed to solid phosphides, which react with moisture to produce phosphine gas, can pose risks to others if phosphides are on clothes, skin, or hair. First Aid responders should protect themselves through the use of appropriate personal protective equipment before attempting to rescue or care for a person who has been exposed to a phosphine-releasing product, and/or if entering a zone with potentially unsafe phosphine levels. A NIOSH/MSHA approved self-contained breathing apparatus (SCBA) operated in a positive pressure mode is recommended in response situations that involve exposure to potentially unsafe or unknown levels of phosphine (see the PRECAUTIONS section of product label or applicator's manual for further guidance regarding personal protective equipment.)

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration using a bag-valve-mask device to prevent possible secondary exposure to phosphine gas to the first aid responder. Do not perform mouth-to-mouth resuscitation. Do not give anything by mouth to an unconscious person. Call a poison control centre or doctor immediately for further treatment advice.

IF SWALLOWED: Call a poison control centre or doctor immediately for treatment advice. DO NOT DRINK WATER. Do not administer anything by mouth or make the person vomit. It is likely that this exposure will lead to spontaneous vomiting.

IF ON SKIN OR CLOTHING: Brush or shake material off clothes and shoes in a well ventilated area. Allow clothes to aerate in a ventilated area prior to laundering. Do not leave contaminated clothing in occupied and/or confined areas such as automobiles, vans, motel rooms, etc. Wash contaminated skin thoroughly with soap and water for 15-20 minutes. Call a poison control centre or doctor for further treatment advice.

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control centre or doctor for treatment advice.

HOT LINE NUMBER

Have the product container label or Applicator's Manual with you when calling a poison control centre, doctor, or when going for treatment. **CONTACT 1-800-308-4856 FOR ASSISTANCE WITH HUMAN OR ANIMAL MEDICAL EMERGENCIES.** You may also contact DEGESCH AMERICA, INC. 540-234-9281/1-800-330-2525 or, GARDEX CHEMICALS, LTD. 416-675-1638. For all other chemical emergencies, please contact CHEMTREC – 1-800-424-9300 or Canadian Transport Emergency Centre (CANUTEC) 613-996-6666.

3. TOXICOLOGICAL INFORMATION

Aluminum phosphide tablets, pellets or dust will react with moisture from the air, acids and many other liquids to release hydrogen phosphide (phosphine, PH_3) gas. Mild exposure by inhalation causes malaise (indefinite feeling of sickness), ringing in the ears, fatigue, nausea and pressure in the chest which is relieved by removal to fresh air. Moderate poisoning causes weakness, vomiting, pain just above the stomach, chest pain, diarrhea and dyspnea (difficulty in breathing).

Symptoms of severe poisoning may occur within a few hours to several days resulting in pulmonary edema (fluid in lungs) and may lead to dizziness, cyanosis (blue or purple skin colour), unconsciousness, and death.

In sufficient quantity, phosphine affects the liver, kidneys, lungs, nervous system and circulatory system. Inhalation can cause lung edema (fluid in lungs) and hyperaemia (excess of blood in a body part), small perivascular brain hemorrhages and brain edema (fluid in brain). Metal phosphide fumigants are poisonous if swallowed. Ingestion can cause lung and brain symptoms, but damage to the viscera (body cavity organs) is more common. Phosphine poisoning may result in (1) pulmonary edema, (2) liver elevated serum GOT, LDH and alkaline phosphatase, reduced prothrombin, hemorrhage and jaundice (yellow skin colour) and (3) kidney haematuria (blood in urine) and anuria (abnormal or lack of urination). Pathology is characteristic of hypoxia (oxygen deficiency in body tissue). Frequent exposure to concentrations above permissible levels over a period of days or weeks may cause poisoning. Treat symptomatically.

The following measures are suggested for use by the physician in accordance with his/her own judgement:

In its milder forms, symptoms of poisoning may take some time (up to 24 hours) to make their appearance, and the following is suggested.

1. Give complete rest for 1-2 days, during which the patient must be kept quiet and warm.
2. Should patient suffer from vomiting or increased blood sugar, appropriate solutions should be administered.

Treatment with oxygen breathing equipment is recommended as is the administration of cardiac and circulatory stimulants.

In cases of severe poisoning (Intensive Care Unit recommended):

1. Where pulmonary edema is observed, steroid therapy should be considered and close medical supervision is recommended. Blood transfusions may be necessary.
2. In case of manifest pulmonary edema, venesection should be performed under vein pressure control. Heart glycosides (I.V.) (in case of haemoconcentration, venesection may result in shock). On progressive edema of the lungs: immediate intubation with a constant removal of edema fluid and oxygen over-pressure respiration, as well as any measures required for shock treatment. In case of kidney failure, extracorporeal haemodialysis is necessary. There is no specific antidote known for this poisoning.
3. Mention should be made here of suicidal attempts by taking solid phosphide by mouth. After swallowing: emptying of the stomach by vomiting, flushing of the stomach with diluted potassium permanganate solution or a solution of magnesium peroxide until flushing liquid ceases to smell of carbide. Thereafter, apply medicinal charcoal.

4. PRECAUTIONS

4.1 **DANGER: Hazardous to Humans, Domestic Animals and Nesting Birds – KEEP OUT OF REACH OF CHILDREN**

If this pest control product is to be used on a commodity that may be exported to the U.S. and you require information on acceptable residue levels in the U.S., visit CropLife Canada's web site at www.croplife.ca

Aluminum phosphide from Phostoxin® tablets, pellets or dust may be fatal if swallowed. Do not get in eyes, on skin or on clothing. Do not eat, drink or smoke while handling aluminum phosphide fumigants. If a sealed container is opened, or if the material comes into contact with water, acids or other liquids these products will release hydrogen phosphide (phosphine, PH₃) which is an extremely toxic gas. If a garlic odour is detected, refer to the information on Industrial Hygiene Monitoring (section 6.6) of this Applicator's Manual for appropriate monitoring procedures. Pure hydrogen phosphide gas is odourless; the garlic odour is due to a contaminant.

Since the odour of hydrogen phosphide may not be detected under some circumstances, the absence of a garlic odour does not mean that dangerous levels of hydrogen phosphide gas are absent. Observe proper reentry procedures specified elsewhere in the labelling to prevent overexposure. In situations where ventilation of buildings is required following fumigation (e.g. warehouses), phosphine gas may pose a potential hazard to small birds (e.g. swallows) nesting on or near those structures. Therefore, carefully inspect the outside of the structure prior to application of the fumigant to ensure the absence of nesting birds.

4.2 Physical and Chemical Hazards

Aluminum phosphide in tablets, pellets and partially spent dust will release hydrogen phosphide if exposed to moisture from the air or if it comes into contact with water, acids and many other liquids. Since hydrogen phosphide may ignite spontaneously at levels above its lower flammable limit of 1.8% v/v, it is important not to exceed this concentration. Ignition of high concentrations of hydrogen phosphide can produce a very energetic reaction. Explosions can occur under these conditions and may cause severe personal injury. **Never allow the build-up of hydrogen phosphide to exceed explosive concentrations.** Do not confine spent or partially spent metal phosphide fumigants as the slow release of hydrogen phosphide from these materials may result in formation of an explosive atmosphere. Piling of tablets, pellets or bags or the addition of liquid to the product is prohibited. This may cause a temperature increase, increase the rate of gas production and confine the gas so that ignition could occur.

It is preferable to open containers of aluminum phosphide products in open air, as under certain conditions, they may flash upon opening. Containers may also be opened near a fan or other appropriate ventilation which will rapidly exhaust contaminated air. When opening, point the container away from the face and body and slowly loosen the cap. Although the chances for a flash are very remote, never open these containers in a flammable atmosphere. These precautions will also reduce the fumigator's exposure to hydrogen phosphide.

Pure phosphine (hydrogen phosphide) gas is practically insoluble in water, fats and oils, and is stable at normal fumigation temperatures. However, phosphine will corrode copper and precious metals at high concentrations or humidities. Protection or removal of wiring, sensitive equipment or precious metals is recommended under these conditions. Thus, small electric motors, smoke detectors, brass sprinkler heads, batteries and battery chargers, fork lifts, temperature monitoring systems, switching gears, communication devices, computers, calculators and other electrical equipment should be protected or removed before fumigation. Hydrogen phosphide will also react with certain metallic salts and, therefore, sensitive items such as photographic film, some inorganic pigments, etc., should not be exposed.

4.3 Environmental Hazards

DO NOT contaminate irrigation or drinking water supplies or aquatic habitats such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands by cleaning of equipment or disposal of wastes.

5. PROTECTIVE CLOTHING

Wear dry gloves of cotton or other breathable material if contact with Phostoxin® tablets, pellets or dust is likely. Wear a loose fitting long sleeve shirt, long pants, shoes and socks. After fumigation activities, remove all protective clothing, aerate in a well ventilated area then wash thoroughly, separately, before re-use.

If Phostoxin® tablets or pellets become trapped inside clothing, remove clothing, wash hands and exposed skin thoroughly, shower and change into clean clothing.

If application of fumigant is performed from within the structure to be fumigated, approved respiratory protection against phosphine must be worn during fumigation, by all personnel in the structure (see below).

6. RESPIRATORY PROTECTION

6.1 When Respiratory Protection Must Be Worn

NIOSH/MSHA approved respiratory protection must be worn if worker exposure limits cannot be met through engineering controls (such as forced air ventilation) and/or appropriate worker practices. For

example, if application of the fumigant is performed from within the structure to be fumigated, approved respiratory protection is required to be worn by all personnel inside the structure. Respiratory protection is also required to be worn upon reentry into a partially aerated structure, (e.g. upon initiation of aeration or after aeration when testing for re-entry), and when attending to spills and leaks. When required, gas concentration measurements for safety purposes may be made using low level detector tubes*. See the section on Applicator and Worker Exposure for monitoring requirements.

The respiratory protection must fit properly, any obstruction to a proper fit should be removed (e.g. beard, long sideburns).

*Information on hydrogen phosphide (phosphine, PH_3) detector tubes may be obtained from your distributor.

6.2 Permissible Gas Concentration Ranges for Respiratory Protection Devices

A NIOSH/MSHA approved air-purifying full-face gas mask with a chin style mounted canister approved for phosphine OR a NIOSH/MSHA approved supplied-air respirator with a full face piece must be used at levels up to 5 ppm. Above this level, or in situations where the hydrogen phosphide concentration is unknown, a NIOSH/MSHA approved self-contained breathing apparatus (SCBA) must be worn and operated in a positive pressure mode.

6.3 Requirements for Availability of Respiratory Protection for outside applications

Respiratory protection must also be available for applications from outside the area to be fumigated such as addition of tablets or pellets to automatic dispensing devices, or outdoor applications even if exposures above the permitted exposure limits are not expected. Observe Provincial pesticide regulations.

7. APPLICATOR AND WORKER EXPOSURE

7.1 Hydrogen Phosphide Exposure Limits

Exposure to hydrogen phosphide must never exceed 0.1 ppm for applicators and workers during application. Application is defined as the time period covering the opening of the first container, applying the appropriate dosage of fumigant and closing up the site to be fumigated. All persons in the treated site and in adjacent indoor areas are covered by this exposure standard. Periodic gas measurements should be made in the worker's breathing zone using phosphine detector tubes or another suitable detector, unless they are protected by a NIOSH/MSHA approved supplied air respirator operated in a positive pressure mode.

The level of phosphine gas may be higher at the core of the commodity than the surrounding air. Monitoring is required when unloading or otherwise disturbing a commodity that has been fumigated to ensure that liberation of gas from the treated commodity does not result in unacceptable levels of hydrogen phosphide.

7.2 Application of Fumigant

Depending upon temperature and humidity, Phostoxin® releases hydrogen phosphide gas slowly upon exposure to moisture from the air. If the fumigator's exposure exceeds 0.1 ppm, approved respiratory protection must be worn. If Phostoxin® is to be applied from within the structure to be fumigated, approved respiratory protection must be worn by all personnel inside the structure. When required, gas concentration measurements for safety purposes may be made using low level detector tubes. See the information on Industrial Hygiene Monitoring in Section 7.6 of this Applicator's Manual.

7.3 **Leakage from Fumigated Sites**

Hydrogen phosphide is highly mobile and given enough time may penetrate seemingly gas-tight materials such as concrete and cinder block. Therefore, adjacent, enclosed areas likely to be occupied should be examined to ensure that significant leakage has not occurred. Sealing of the fumigated site and/or air flow in the occupied areas must be sufficient to meet exposure standards.

7.4 **Aeration and Reentry**

If the area is to be entered after fumigation, it must be aerated until the level of hydrogen phosphide gas is 0.1 ppm or below. The area or site must be monitored to ensure that liberation of gas from the treated commodity does not result in the development of unacceptable levels of hydrogen phosphide. Do not allow reentry into treated areas by any person before this time unless protected by an approved respirator. A NIOSH/MSHA approved self-contained breathing apparatus with a positive pressure mode must be worn during testing of the phosphine level and during initiation of aeration, if re-entry of the fumigated structure is necessary.

Adhere to provincial ambient air quality criteria standards and monitor downwind gas levels. Ensure that the deactivation area is secure and placarded to prevent public and unauthorized worker access.

7.5 **Handling Un-Aerated Commodities**

Exposure to hydrogen phosphide must never exceed the 0.1 ppm during moving, storage or processing of incompletely aerated commodities.

The level of phosphine gas may be higher at the core of the commodity than the surrounding air. Monitoring is required when unloading or otherwise disturbing a commodity that has been fumigated to ensure that liberation of gas from the treated commodity does not result in unacceptable levels of hydrogen phosphide.

7.6 **Industrial Hygiene Monitoring**

Periodic gas measurements should be made in the worker's breathing zone using phosphine detector tubes or another suitable detector, unless they are protected by a NIOSH/MSHA approved supplied air respirator operated in a positive pressure mode.

It is recommended that hydrogen phosphide exposures be documented in an operations log or manual for each site and operation where exposures may occur. The purpose of this monitoring is to prevent excessive exposures, to verify whether the appropriate respirator is being worn during fumigation within a structure and whether respiratory protection is required upon re-entry after aeration. This monitoring is mandatory although, once exposures have been adequately characterized, subsequent monitoring is not routinely required. However, spot checks should be made occasionally, especially if conditions change significantly or if an unexpected garlic odour is detected. Gas measurements should be made in the worker's breathing zone. Monitoring is not required for outdoor operations.

There are a number of devices on the market for the measurement of hydrogen phosphide gas levels for industrial hygiene purposes. One of these is the hydrogen phosphide detector tube used in conjunction with the appropriate hand-operated air sampling pump. These devices are reliable, portable, simple to use, do not require extensive training and are relatively rapid, inexpensive and accurate. Low level detector tubes are available which can detect 0.1 ppm and are suitable for industrial hygiene monitoring. Information on hydrogen phosphide (phosphine, PH₃) detector tubes may be obtained from your distributor.

8. **PLACARDING OF FUMIGATED AREAS**

The applicator must placard or post all entrances to the structures under fumigation with placards at least 35cm long and 25cm wide that are made of substantial material that can be expected to withstand adverse weather conditions bearing the following information:

1. The signal word DANGER in letters at least 7cm high and the SKULL AND CROSSBONES symbol in red.
2. The statement "Area and/or commodity under fumigation, DO NOT ENTER".
3. The statement, "This sign may only be removed after the commodity is completely aerated (contains 0.1 ppm or less of phosphine). Transport of incompletely aerated commodities to a new site is permissible by rail or ship only, and the new storage site must be placarded if its concentration in phosphine is above 0.1 ppm. Trucks, vans, trailers and similar transport vehicles cannot be moved over public roads or highways until they are aerated and the warning placards removed. If workers must handle incompletely aerated commodity, or are indoors (e.g. an enclosed elevator head) they are to wear appropriate respiratory protection."
4. The date and time fumigation begins and date and time which aeration can begin.
5. Name of fumigant used.
6. Name, address and telephone number of the applicator.
7. Placards must bear a 24-hour emergency response telephone number.

All entrances to the fumigated and deactivation areas must be placarded. Where possible, placards should be placed in advance of the fumigation to keep unauthorized persons away.

For railroad hopper cars, placards must be placed on both sides of the car near the ladders and next to the top hatches into which the fumigant is introduced.

Do not remove placards until the treated commodity is aerated down to 0.1 ppm hydrogen phosphide or less. To determine whether aeration is complete, each fumigated site or vehicle must be monitored and shown to contain 0.1 ppm or less hydrogen phosphide gas in the air space around and, if feasible, in the mass of the commodity.

It is recommended that the persons responsible for removing placards be familiar with the physical, chemical and toxicological properties of hydrogen phosphide. They should also be knowledgeable in making gas concentration measurements, exposure limits and symptoms and first aid treatment for hydrogen phosphide poisoning.

9. **FUMIGATION MANAGEMENT PLAN**

The certified applicator is responsible for working with the owners and/or responsible employees of the site to be fumigated to develop and follow a Fumigation Management Plan (FMP). The FMP is intended to ensure a safe and effective fumigation. The FMP must address characterization of the site, and include appropriate monitoring and notification requirements, consistent with, but not limited to, the following:

1. Inspect the site to determine its suitability for fumigation.
2. When sealing is required, consult previous records for any changes to the structure, seal leaks, and monitor any occupied adjacent buildings to ensure safety.
3. Prior to each fumigation, review any existing FMP, MSDS, Applicator's Manual and other relevant safety procedures with company officials and appropriate employees.
4. Consult company officials in the development of procedures and appropriate safety measures for nearby workers that will be in and around the area during application and aeration.
5. Consult with company officials to develop an appropriate monitoring plan that will confirm that nearby workers and bystanders are not exposed to levels above the allowed limits during application, fumigation and aeration. This plan must also demonstrate that nearby residents will not be exposed to concentrations above the allowable limits.

6. Consult with company officials to develop procedures for local authorities to notify nearby residents in the event of an emergency.
7. Confirm the placement of placards to secure entrance into any structure under fumigation.
8. Confirm the required safety equipment is in place and the necessary manpower is available to complete a safe and effective fumigation.
9. Written notification must be provided to the receiver of a vehicle that is fumigated in transit (i.e., fumigation in transit is permitted by rail or ship only).

These factors **must** be considered in putting a FMP together. It is important to note that some plans will be more comprehensive than others. All plans should reflect the experience and expertise of the applicator and circumstances at and around the structure and/or area.

In addition to the plan, the applicator must read the entire label and the Applicator's Manual and follow its directions carefully. If the applicator has any questions about the development of a FMP, contact the supplier for further assistance.

The FMP and related documentation, including monitoring records, must be maintained for a minimum of 2 years.

GUIDANCE FOR PREPARATION OF A FUMIGATION MANAGEMENT PLAN

Purpose

A Fumigation Management Plan (FMP) is an organized, written description of the required steps involved to help ensure a safe, legal and effective fumigation. It will also assist you and others in complying with pesticide product label requirements. The guidance that follows is designed to help assist you in addressing all the necessary factors involved in preparing for and fumigating a structure and/or area.

This guidance is intended to help you organize any fumigation that you might perform, **PRIOR TO ACTUAL TREATMENT**. It is meant to be somewhat prescriptive, yet flexible enough to allow the experience and expertise of the fumigator to make changes based on circumstances which may exist in the field. By following a step-by-step procedure, yet allowing for flexibility, a safe and effective fumigation can be performed.

Before any fumigation begins, carefully read and review the label and the Applicator's Manual. This information must also be given to the appropriate company officials (supervisors, foreman, safety officer, etc.) in charge of the site. Preparation is the key to any successful fumigation. If you do not find specific instructions for the type of fumigation that you are to perform listed in this Guidance Document, you will want to construct a similar set of procedures using this document as your guide or contact Degesch America, Inc. for assistance. Finally, before any fumigation begins, you must be familiar with and comply with all applicable federal, provincial and municipal laws and regulations. The success of the fumigation is not only dependent on your ability to do your job but also upon carefully following all rules, regulations and procedures required by governmental agencies.

A CHECKLIST GUIDE FOR A FUMIGATION MANAGEMENT PLAN

This checklist is provided to help you take into account factors that must be addressed prior to performing all fumigations. It emphasizes safety steps to protect people and property. The checklist is general in nature and cannot be expected to apply to all types of fumigation situations. It is to be used as a guide to prepare the required plan. Each item must be considered. However, it is understood that each fumigation is different and not all items will be necessary for each fumigation site.

A. PRELIMINARY PLANNING AND PREPARATION

1. Determine the purpose of the fumigation.
 - a. Control of insect infestation
 - b. Control of vertebrate pests
 - c. Plant pest quarantine

2. Determine the type of fumigation. For example:
 - a. Space: tarp, mill, warehouse, food processing plant,
 - b. Vehicle: railcar, truck, van, container
 - c. Commodity: raw agricultural or processed foods or non-food
 - d. Type of storage: vertical silo, farm storage, flat storage, etc.
 - e. Vessels: ship or barge. In addition to the Applicator's Manual, read the Cargo, Fumigation and Tackle Regulations under the *Canada Shipping Act, 2001*.

3. Fully acquaint yourself with the site and commodity to be fumigated, including:
 - a. The general structure layout, construction (materials, design, age, maintenance), of the structure, fire or combustibility hazards, connecting structures and escape routes, above and below ground, and other unique hazards or structural characteristics. Prepare, with the owner/operator/person in charge, a drawing or sketch of structure to be fumigated, delineating features, hazards, and other structural characteristics.
 - b. The number and identification of persons who routinely enter the area to be fumigated (i.e. employees, visitors, customers, etc.)
 - c. The specific commodity to be fumigated, its mode of storage, and its condition.
 - d. The previous treatment history of the commodity, if available.
 - e. Accessibility of utility service connections
 - f. Nearest telephone or other means of communication. Mark the location of these items on the drawing/sketch.
 - g. Emergency shut-off stations for electricity, water and gas. Mark the location of these items on the drawing/sketch.
 - h. Current emergency telephone numbers of local health, fire, police, hospital and physician responders.
 - i. Name and phone number (both day and night) of appropriate company officials.
 - j. Check, mark and prepare the points of fumigant application locations if the job involves entry into the structure for fumigation.
 - k. Review labeling and Applicator's Manual
 - l. Location of command centre
 - m. Exposure time considerations:
 1. Product (tablet and pellets and sachet) to be used
 2. Minimum fumigation period, as defined and described by the label use directions.
 3. Down time required to be available
 4. Aeration requirements
 5. Cleanup requirements, including dry or wet deactivation methods, equipment, and personnel needs, if necessary.
 6. Measured and recorded commodity temperature and moisture
 - n. Determination of dosage:
 1. Cubic footage or other appropriate space/location calculations
 2. Structure sealing capability and methods
 3. Label recommendations
 4. Temperature, humidity, wind
 5. Commodity/space volume
 6. Past history of fumigation of structure
 7. Exposure time
 8. Amount of fumigant used
 9. Actual concentration achieved
 - o. Distance to other on-site and neighbouring off-site structures, recreational areas or areas where bystanders may be exposed.
 - p. Site of aeration vent(s) to be opened to aerate structure.

B. PERSONNEL

1. Confirm in writing that all personnel in and around the site to be fumigated have been notified prior to application of the fumigant. Consider using a checklist that each employee initials indicating they have been notified.
2. Instruct all fumigation personnel to read the Applicator's Manual concerning the hazards that may be encountered, and about the selection of personal protection devices, including sufficiently sensitive detection equipment.
3. Confirm that all personnel are aware of and know how to proceed in case of an emergency situation.
4. Instruct all personnel on how to report any accident and/or incidents related to fumigant exposure. Provide a telephone number for emergency response reporting.
5. Instruct all personnel to report to proper authorities any theft of fumigant and/or equipment related to fumigation.
6. Establish a meeting area for all personnel in case of an emergency.

C. MONITORING

1. Safety
 - a. Scheduled ambient air monitoring of phosphine concentrations must be conducted, downwind, along the fumigation boundary to prevent worker and bystander exposure to concentrations of hydrogen phosphide ≥ 0.1 ppm*** and to determine where exposures may occur. It may be necessary to monitor gas levels in other areas as well. Document where monitoring will occur.
 - b. Monitor (and record) the wind direction and adjust the phosphine monitoring if wind direction changes over the fumigation/aeration period.
 - c. Keep a log or manual of monitoring records for each fumigation site. This log must, at a minimum, contain the timing, number of readings taken and level of concentrations found in each location.
 - d. When monitoring, document any phosphine level even if it is present below the limit of detection.
 - e. Outdoor air monitoring must be conducted during fumigation and aeration and corrective action must be taken if gas levels exceed the allowed levels in an area where bystanders and/or nearby residents or domestic animals may be located. Monitor gas levels at the fumigation boundary (downwind locations) continuously for one hour, commencing six hours after the introduction of phosphine gas, followed by once every six hours to the beginning of aeration. During aeration, monitor gas levels continuously until the structure is ready for re-entry.

*****NOTE: An evacuation action is necessary when phosphine levels exceed 0.1 ppm.** To determine phosphine levels, a properly calibrated digital portable gas monitoring unit is needed with alarm capability for the STEL and TWA. (e.g., Draeger Mini Warn, Draeger Micro Pac Plus, Draeger, Pac III, Draeger Multi Warn, Porta Sens or similar equipment).

2. Efficacy
 - a. Phosphine readings should be taken from within the fumigated structure to insure proper gas concentrations, along with temperature and relative humidity readings. Readings must be taken immediately after introduction of the product, six hours after the introduction of the product followed by a reading every twelve hours during the fumigation period. Finally, phosphine readings should be taken every thirty minutes until aeration is complete.
 - b. All phosphine, temperature and relative humidity readings should be documented.

D. NOTIFICATION

1. Confirm all the appropriate local authorities (fire departments, police departments, etc.) have been notified as per label instructions, local ordinances, or instructions of the client.
2. Prepare written procedure ("Emergency Response Plan"), which contains explicit instructions, names, and telephone numbers so as to be able to notify local authorities if phosphine levels are exceeded in an area that could be dangerous to bystanders and/or domestic animals. Elaborate in this section the key elements of an Emergency Response Plan including reference to evacuation procedures, etc.
3. Confirm that the receiver of in-transit vehicles under fumigation have been notified and are trained according to Section 10.6.7 of this Applicator's Manual.

E. SEALING PROCEDURES

1. Sealing must be adequate to control the pests. Care should be taken to ensure that sealing materials will remain intact until the fumigation is complete.
2. If the site has been fumigated before, review the previous FMP for previous sealing information.
3. Make sure that construction/remodeling has not changed the building in a manner that will affect the fumigation.
4. Warning placards must be placed on every possible entrance to the fumigation site.

F. APPLICATION PROCEDURES AND FUMIGATION PERIOD

1. Plan carefully and apply the product in accordance with the label requirements.
2. When entering into the area under fumigation, always work with two or more people under the direct supervision of a certified applicator wearing appropriate respirators.
3. Apply fumigant from the outside when and where appropriate.
4. Provide watchmen when the possibility of entry into the fumigation site by unauthorized person cannot otherwise be assured (e.g., by secondary locks, barricades, etc.).
5. When entering structures, always follow applicable provincial legislation for confined spaces.
6. Document that the receiver of vehicles/containers fumigated in-transit has been notified.

7. Turn off any electric lights in the fumigated area of the structure, as well as all non-essential electrical motors.

G. POST-APPLICATION OPERATIONS

1. Provide watchmen when you cannot secure the fumigation site from entry (e.g., by secondary locks, barricades, etc.) by unauthorized persons during the aeration process.
2. Ventilate and aerate in accordance with structural limitations and nearby occupied areas so as to minimize bystander exposure.
3. Turn on ventilating or aeration fans where appropriate.
4. Determine gas concentration in the fumigated environment from outside if possible. Use a sufficiently sensitive gas detector before re-entry into a fumigated structure to determine fumigant concentration.
5. During aeration, monitor gas levels continuously until the structure is ready for re-entry.
6. Keep written records of monitoring to document completion of aeration.
7. Consider temperature when aerating.
8. Ensure that aeration is complete before moving a treated vehicle onto public roads.
9. Remove warning placards when aeration is complete and the fumigated space has been cleared for re-entry using a detection device of sufficient sensitivity.
10. Inform business/client that employees/other persons may return to work or otherwise be allowed to re-enter the aerated structure.

10. DIRECTIONS FOR USE

10.1 General

- 10.1.1 The use of Phostoxin® is Restricted due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH₃) gas. These products are for retail sale to and use only by provincially licensed personnel for those uses covered by the applicator's certification, or workers trained in accordance with the Applicator's Manual and working under the direct supervision and in the physical presence of the certified applicator. Physical presence means on site or on the premises. Read and follow the label and this Applicator's Manual which contains complete instructions for the safe use of this pesticide.
- 10.1.2 Aluminum phosphide is a highly hazardous material and should be used only by individuals trained in its proper use. Before using, read and follow all label precautions and directions.

Additional copies of this Applicator's Manual are available from:

Degesch America, Inc.
153 Triangle Drive
P. O. Box 116
Weyers Cave, VA 24486 USA
Telephone: 540-234-9281/1-800-330-2525
Internet: www.degeschamerica.com
E-Mail: degesch@degeschamerica.com

Persons working with aluminum phosphide should be knowledgeable of the hazards of this chemical and trained in the use of required respiratory equipment and detector devices, emergency procedures, and use of the fumigant.

- 10.1.3 At least two persons, a certified applicator and trained person, or two trained persons under the direct supervision of the certified applicator must be present during fumigation of structures when entry into the structure for application of the fumigant is required.

At least two persons, a certified applicator and trained person, or two trained persons under the direct supervision of a certified applicator, must be present and must wear the proper safety equipment when a structure that is under fumigation is to be entered.

The certified applicator must maintain visual and/or voice contact with all fumigation workers during the application of the fumigants.

Large scale (permit) fumigations may require the posting of guards to prevent entry into the area under fumigation. Refer to Provincial pesticide regulations.

- 10.1.4 Shipholds, containers on ships, railroad cars and containers shipped piggyback by rail may be fumigated in transit. Aeration of railcars, railroad boxcars or shipping containers is prohibited en route.

Trucks, vans, trailers and similar transport vehicles cannot be moved over public roads or highways until they are aerated and the warning placards removed.

- 10.1.5 Do not fumigate commodities with aluminum phosphide when commodity temperature is below 5°C (40°F).

- 10.1.6 The site to be fumigated must first be inspected to determine if it can be made sufficiently gas tight. Then a plan should be developed to provide for safe and efficient application of the fumigant to include emergency procedures, etc., where required, and to decide how monitoring should be conducted to prevent excessive exposures.

- 10.1.7 Wear dry gloves of cotton or other breathable material while handling Phostoxin®. Wash hands thoroughly after use.

- 10.1.8 Hydrogen phosphide gas may flash at concentrations above its flammable limit. **Do not open Phostoxin® containers in an explosive environment (e.g. flour mill).** It is preferable to open them in open air, near a fan or other appropriate ventilation which will rapidly exhaust contaminated air. These precautions will also reduce the applicator's exposure to hydrogen phosphide gas.

- 10.1.9 Contact with liquids is prohibited. Liquids in contact with unreacted aluminum phosphide will greatly accelerate the production of hydrogen phosphide gas which would result in a toxic and/or fire hazard.

- 10.1.10 Piling of tablets, pellets or bags or the addition of liquid to the product is prohibited.

- 10.1.11 As much as is possible, protect unused Phostoxin® from excessive exposure to atmospheric moisture during application and tightly reseal the aluminum flask prior to returning pellets or tablets to storage.

- 10.1.12 Hydrogen phosphide gas may react with certain metals and their salts to produce corrosion. This gas is corrosive to copper, copper alloys and precious metals such as silver and gold. Sensitive equipment and items containing these elements should be removed or protected prior to fumigation with aluminum phosphide.

10.1.13 Under no circumstances shall any processed food, feed or bagged commodity come into direct contact with Phostoxin® pellets, tablets or residual dust, or a raw agricultural commodity that will be used directly as a food without further processing.

10.1.14 If Phostoxin® is to be applied from within the structure to be fumigated, approved respiratory protection must be worn by all personnel in the structure. For phosphine levels of up to 5 ppm, a NIOSH/MSHA approved air-purifying full face gas-mask with a chin style mounted canister approved for phosphine OR a NIOSH/MSHA approved supplied air respirator with a full face piece must be worn.

In situations where the phosphine concentration is unknown or is greater than 5 ppm (e.g. If reentry before complete aeration is necessary), a NIOSH/MSHA approved self-contained breathing apparatus (SCBA) must be worn and operated in a positive pressure mode.

Respiratory protection need not be worn, but must be available for uses such as outdoor application, addition of pellets to automatic dispensing devices, etc., even if exposures above the allowable limits are not expected. Observe all Provincial pesticide regulations.

10.1.15 Notify appropriate company employees prior to fumigation and provide relevant safety information to local officials (fire department, police, etc.) for use in the event of an emergency. Observe all Provincial pesticide regulations.

10.2. Pests Controlled

Phostoxin® has been found effective against the following animals, insects and their pre-adult stages - that is eggs, larvae and pupae. These include:

Almond moth	Flat grain beetle	Mice
Angoumois grain moth	Flour beetle	Nematodes
Bean weevil	Fruit flies (small)	Pink bollworm
Bees	Grain moth	Raisin moth
Cadelle	Granary weevil	Red flour beetle
Cereal leaf beetle	Greater wax moth	Rice weevil
Cigarette beetle	Hairy fungus beetle	Rodents
Cockroaches	Hessian fly	Rusty grain beetle
Confused flour beetle	Indian meal moth	Saw-toothed grain beetle
Dermestid beetles	Khapra beetle	Spider beetles
Dried fruit beetle	Lesser grain borer	Tobacco moth
Dried fruit moth	Maize weevil	Wood boring beetles
Drug store beetle	Mediterranean flour moth	Yellow meal worm
European grain moth	Merchant grain beetle	

Rodent pests may be controlled using Phostoxin® Pellets and Tablets. Although it is possible to achieve total control of the listed insect pests, this is frequently not realized in actual practice. Factors contributing to less than 100% control are leaks, poor gas distribution, unfavourable exposure conditions, etc. In addition, some insects are less susceptible to hydrogen phosphide than others. If maximum control is to be attained, extreme care must be taken in sealing, the higher dosages must be used, exposure periods lengthened, proper application procedures followed and temperature and humidity conditions must be favourable.

10.3 Exposure Conditions

The following table may be used as a guide in determining the minimum length of the exposure period at the indicated temperatures:

Minimum Exposure Periods for Phostoxin®

TEMPERATURE	EXPOSURE PERIOD
below 5°C (40°F)	Do not fumigate*
5° - 12°C (40° - 53°F)	10 days (240 hours)
13° - 15°C (54° - 59°F)	5 days (120 hours)
16° - 20°C (60° - 68°F)	4 days (96 hours)
above 20°C (68°F)	3 days (72 hours)

*If the temperature drops below 5°C during a fumigation, deactivate the Phostoxin® at the end of the fumigation period, as detailed in the Spill and Leak Procedures (Sec. 13).

The length of the fumigation must be great enough so as to provide for adequate control of the insect pests which infest the commodity being treated. Additionally, the fumigation period should be long enough to allow for complete reaction of Phostoxin® with moisture so that little or no unreacted aluminum phosphide remains. This will minimize worker exposures during further storage and/or processing of the treated bulk commodity as well as reduce hazards in the disposal of partially spent aluminum phosphide products remaining after space fumigations. The proper length of the fumigation period will vary with exposure conditions since, in general, insects are more difficult to control at lower temperatures and the rate of hydrogen phosphide gas production is less at lower temperatures and humidities.

It should be noted that there is little to be gained by extending the exposure period if the structure to be fumigated has not been carefully sealed or if the distribution of gas is poor and insects are not subjected to lethal concentrations of hydrogen phosphide. Careful sealing is required to ensure that adequate gas levels are retained and proper application procedures must be followed to provide satisfactory distribution of hydrogen phosphide gas. Some structures can only be treated when completely tarped while others cannot be properly sealed by any means and should not be fumigated. Exposure times must be lengthened to allow for penetration of gas throughout the commodity when fumigant is not uniformly added to the commodity mass, for example, by surface application or shallow probing. This is particularly important in the fumigation of bulk commodity contained in large storages.

Remember, exposure periods recommended in the table are minimum periods and may not be adequate to control all stored products pests under all conditions nor will they always provide for total reaction of Phostoxin®, particularly if temperatures and commodity moisture levels or humidity are low during the fumigation.

10.4 Commodities Which May be Fumigated with Phostoxin®

Phostoxin® may be used for the fumigation of raw agricultural commodities, animal feed, processed foods, tobacco and certain other non-food items.

10.4.1 Raw Agricultural Commodities, Animal Feeds and Processed Foods

Phostoxin® may be used for the treatment of grain pests in stored barley, cocoa beans, coffee beans, corn, cotton seeds, dates, dried peas, lentils, millet, nuts in shells, oats, peanuts, popcorn, rice, rye, sorghum, soybeans, sunflower seeds, triticale, wheat, all processed foods and feeds. Phostoxin® may also be used to fumigate bagged, packaged or treated cereal, grass, sorghum or small legume seeds destined for planting

use only. Pellets or tablets may be added directly to animal feed, and raw agricultural commodities stored in bulk. For those commodities not stored in bulk, fumigation using Phostoxin® Prepacs is recommended. Under no circumstances shall any processed food, feed or bagged commodity come into direct contact with Phostoxin® pellets, tablets or residual dust, or a raw agricultural commodity that will be used directly as a food without further processing.

10.4.2 Non-Food Commodities, Including Tobacco

The following non-food items may be fumigated with Phostoxin®:

Dried Plants and Flowers
 Feathers
 Human Hair, Rubberized Hair, Vulcanized Hair, Mohair Leather
 Products, Animal Hides and Furs
 Paper and Paper Products
 Processed or Unprocessed Cotton, Wool and Other Natural Fibers or Cloth, Clothing
 Seeds (grass seed, ornamental herbaceous plant seed and vegetable seed)
 Straw and Hay
 Tobacco
 Wood and Wood Products

Tobacco and other non-food commodities should not be contacted by pellets, tablets or residual dust.

10.5 Recommended Dosages

Hydrogen phosphide is a mobile gas and will penetrate to all parts of the storage structure. Therefore, dosage must be based upon the total volume of the space being treated and not on the amount of commodity it contains. The same amount of Phostoxin® is required to treat a 1092 kL (30,000 bushel) silo whether it is empty or full of grain unless, of course, the surface of the commodity is sealed off by a tarpaulin. The following dosage ranges are recommended for bulk and space fumigations:

Dosage Guidelines for Fumigations with Phostoxin® Pellets or Tablets

PRODUCT	per 100m ³ *	per 100 tonnes*
Pellets	350 - 2560	480 - 3600
Tablets	70 - 500	100 - 720

*Dosage rates for dates, nuts & dried fruits is 350-700 pellets or 70-140 tablets/100m³; 500-1000 pellets or 100-200 tablets/100 tonnes.

These dosages are not to be exceeded. It is important to be aware that a shortened exposure period cannot be fully compensated by an increased dosage of Phostoxin®.

The wide range of dosages listed above is required to handle the variety of fumigation situations encountered in practice. Somewhat higher dosages are usually recommended under cooler, drier conditions or where exposure periods are relatively short. However, the major factor in selection of dosage is the ability of the structure to hold hydrogen phosphide gas during the fumigation. Modern, well-sealed warehouses may be treated with a low dosage, while more poorly constructed buildings may require the upper end of the dosage range. In certain other fumigations, proper distribution of lethal concentrations of gas to reach all parts of the structure becomes a very important factor in dose selection. An example where this may occur is in the treatment of grain stored in tall silos. Poor gas distribution frequently results when the fumigant

cannot be uniformly added to the grain and it must be treated by surface application. In order to reduce the odds of overdosing, it is recommended that a careful inspection of the site to be fumigated is performed prior to application of the fumigant, including an assessment of the ability of the structure to hold the fumigant and a measure of the temperature and humidity inside the structure. The dosage should be based on the results of that inspection.

Although it is permissible to choose from the full range of dosages listed above, the following dosages are recommended for the various types of fumigations:

Recommended Phostoxin® Dosages for Various Types of Fumigations

DOSAGE RANGE

Type of Fumigation	# of Pellets/ 100m ³	# of Pellets/ 100 tonnes	# of Tablets/ 100m ³	# of Tablets/ 100 tonnes
1. Space (mills, warehouses, etc.)	350-1060		70-200	
Bagged commodities	530-1060		100-200	
Processed dried fruits & nuts	350-700		70-140	
Stored tobacco	350-700		70-140	
2. Bulk Stored Commodities:				
Vertical storages	530-1060	800-1500	100-200	160-300
Tanks	530-1060	800-1800	100-250	160-360
Flat storages (loose construction)	880-2560	1800-3600	250-500	360-720
Grain bins	880-2560	1800-3600	250-500	360-720
Bunkers & tarped ground storages	530-1400	800-2000	100-280	160-400
Railcars	530-1150	800-1500	100-230	160-300
Shipholds	530-1170	800-1600	100-230	160-320

The higher end of the dosage ranges may be required for structures that are of loose construction and in the fumigation of bulk stored commodities in which diffusion will be slowed and result in poor distribution of hydrogen phosphide gas.

10.6 Application Procedures

10.6.1 General Statement

Regardless of the type of storage or structure to be treated, there are several important factors common to all application procedures. A number of these points have been covered in other sections of this Applicator’s Manual but are listed again in the following for completeness.

1. A plan should be devised for application, aeration and disposal of the fumigant so as to keep to a minimum any exposures to hydrogen phosphide. See the requirements for Industrial Hygiene Monitoring under the Applicator and Worker Exposure section of this Applicator’s Manual.
2. Phostoxin® pellets or tablets should be applied so as to provide effective gas concentrations throughout the storage. When pellets or tablets are not applied uniformly to a bulk commodity (surface application in a tall silo or ship’s hold, for example), exposure times should be lengthened to allow for penetration of gas throughout the storage.

3. The storage structure should be sealed so as to maintain a suitable gas concentration over the time period required for control of insect pests.
4. Exposure periods should be long enough to provide for adequate control of insect pests and also complete reaction of the fumigant.
5. Piling of tablets, pellets or bags or the addition of liquid to the product is prohibited.
6. Contact with liquids is prohibited. Liquids in contact with unreacted aluminum phosphide will greatly accelerate the production of hydrogen phosphide gas which would result in a toxic and/or fire hazard.
7. Aluminum phosphide fumigants should not be applied to confined spaces where the concentration of hydrogen phosphide may build up to exceed its lower flammable limit.
8. Observe the precautionary and safety statements mentioned elsewhere in this manual.
9. Phostoxin® will corrode certain metals, especially at high concentrations and humidities. Protection or removal of wiring, sensitive equipment or precious metals is recommended under these conditions.
10. **FOR ALL TYPES OF FUMIGATIONS, IF APPLICATION OF FUMIGANT IS TO BE PERFORMED FROM WITHIN THE STRUCTURE TO BE FUMIGATED, APPROVED RESPIRATORY PROTECTION MUST BE WORN BY ALL PERSONNEL IN THE STRUCTURE. APPROVED RESPIRATORY PROTECTION MUST BE WORN IF RE-ENTRY OF THE TREATED AREA IS NECESSARY BEFORE COMPLETE AERATION (refer to the Respiratory Protection and the Applicator and Worker Exposure sections for approved respiratory protection).**

The following instructions are intended to provide general guidelines for typical fumigations:

10.6.2 Fumigation of Mills, Food Processing Plants and Warehouses

1. Using the label, calculate the duration of the fumigation and the dosage of pellets or tablets to be applied based upon volume of the building, air and/or commodity temperature and the general tightness of the structure.
2. Carefully seal and placard the space to be fumigated.
3. Place trays or sheets of Kraft paper or foil, up to 1 m² (12 square feet) in area, on the floor throughout the structure to hold Phostoxin® pellets or tablets.
4. Spread Phostoxin® on the sheets at a density no greater than 75 pellets or 30 tablets per 0.1 m² (square foot). This corresponds to slightly more than one-half flask of pellets or tablets per 1 m² sheet. Check to see that the Phostoxin® has not piled up and that it is spread out evenly to minimize contact between the individual pellets or tablets.
5. Doors leading to the fumigated space should be closed, sealed, locked and placarded with warning signs.

6. The fumigation period usually lasts from 3 to 5 days depending upon the temperature. Upon completion of the exposure period, windows, doors, vents, etc., should be opened and the fumigated structure allowed to aerate. Do not enter the structure without appropriate respiratory protection until the phosphine concentration is 0.1 ppm or below. When required, gas concentration readings may be taken using low level detector tubes or similar devices to ensure safety of personnel who reenter the treated area. Refer to the section on Applicator and Worker Exposure.
7. Collect the spent Phostoxin® dust and dispose of it, with or without further deactivation, following recommendations given under **Disposal Instructions**.
8. Remove fumigation warning placards only after aeration is complete (See Sec. 8, Placarding of Fumigated Areas).

10.6.3 Fumigation of Vertical Storages (concrete upright bins and other silos in which grain can be rapidly transferred)

1. Close all openings and seal all cracks to make the structure as airtight as possible. Prior to the fumigation, seal the vents near the bin top which connect to adjacent bins.
2. Place warning placards on the discharge gate and on all entrances.
3. Pellets or tablets may be applied continuously by hand. Pellets may also be applied by an automatic dispenser on the headhouse/gallery belt or into the fill opening as the commodity is loaded into the bin. An automatic dispenser may also be used to add pellets into the commodity stream in the up leg of the elevator. **CAUTION: Know how to calibrate the dispenser to deliver the appropriate dosage. To prevent accidental poisoning, ensure that no Phostoxin® remains in the hopper of the automatic dispenser once the commodity has been transferred.**
4. Seal the bin deck openings after the pellets or tablets have been dispensed.
5. Bins requiring more than 24 hours to fill should not be fumigated by continuous addition into the commodity stream. These bins must be fumigated by probing, surface application, or other appropriate means. Exposure periods should be lengthened to allow for diffusion of gas to all parts of the bin if Phostoxin® has not been applied uniformly throughout the commodity mass.

10.6.4 Fumigation of Flat Storages (Flat Houses)

1. Establish a plan for application of fumigants to the structure. Treatment of these types of storages may require considerable effort, therefore, sufficient manpower should be available to complete the work rapidly enough to prevent excessive exposure to hydrogen phosphide gas. Vent flasks outside the storage, conduct fumigations during cooler periods and employ other work practices to minimize exposures. Wear respiratory protection during application. Refer to the sections on Applicator and Worker Exposure (Sec. 7) and Respiratory Protection (Sec. 6).
2. Seal any vents, cracks and other sources of leaks.
3. Post fumigation warning placards.

4. Apply pellets or tablets by surface application, shallow probing, deep probing or uniform addition as the bin is filled.

Storages requiring more than 24 hours to fill should not be treated by addition of fumigant to the commodity stream as large quantities of hydrogen phosphide may escape before the bin is completely sealed.

Probes should be inserted vertically at intervals along the length and width of the flat storage. Pellets or tablets may be dropped into the probe at intervals as it is withdrawn.

Surface application may be used if the bin can be made sufficiently gas tight to contain the fumigant gas long enough for it to penetrate the commodity. In this instance, it is advisable to place about 25 percent of the dosage in the floor level aeration ducts. Check the ducts prior to addition of Phostoxin® to make sure that they contain no liquid water.

5. Tarping the surface of the commodity is often advisable, particularly if the overhead of the storage cannot be well sealed.
6. Lock all entrances to the storage.

10.6.5 Fumigation of Grain Bins

Leakage is the single most important cause of failures in the treatment of grain bins. Since these storages are often small, they usually have a higher leakage area in proportion to their capacity. Most wooden storage structures are so porous that they cannot be successfully fumigated unless they are completely tarped using plastic sheeting or tarpaulins of at least 4 mil thickness. Thicker poly sheeting is recommended to reduce the potential for loss of fumigant. Do not fumigate storages which will be entered by humans or animals prior to aeration.

Seal the bin as tightly as possible. It is recommended that the surface of the grain be covered with plastic sheeting after Phostoxin® has been applied. Tarping the grain surface will greatly reduce the leak rate of the gas as well as reduce the amount of Phostoxin® required. Only the volume below the tarp must be dosed. If not tarped, the entire volume of the storage must be treated, whether full or empty.

A recirculation system which draws gas from above the grain and introduces it to the grain mass will help to establish a uniform hydrogen phosphide concentration throughout the storage.

Place fumigation warning signs on entrances to the bin and near the ladder.

Phostoxin® tablets may be scattered over the surface or probed into the grain using a rigid PVC pipe about 2 metres in length and having a diameter of 32 mm. Use 100 - 250 pellets or 20 - 50 tablets per probe. Spread the dose uniformly over the surface. Immediately cover the surface of the grain with a plastic tarpaulin. Place no more than 25 percent of the total dose at the bottom if the bin is equipped with aeration fans. **Caution:** Make sure that the aeration duct is dry before adding Phostoxin®. Addition of Phostoxin® to liquid in an aeration duct may result in a fire.

Seal the aeration fan with plastic sheeting of 4 mil thickness or greater. Thick poly sheeting not less than 4 mil, is recommended to reduce the potential for loss of fumigant.

Following aeration of the bin, the surface of the grain may be sprayed with an approved protectant to discourage reinfestation.

10.6.6 Bunker and Tarpaulin Fumigations

When possible, conduct tarpaulin fumigations outside. Do not conduct outdoor fumigation of commodities in the proximity of wildlife areas.

Use of plastic sheeting or tarpaulins to cover commodities is one of the easiest and least expensive means for providing relatively gas tight enclosures which are very well suited for fumigation. The volume of these enclosures may vary widely from a few cubic feet, for example, a fumigation tarpaulin placed over a small stack of bagged commodity, to a plastic bunker storage capable of holding 22000 kL (600,000 bushels) of grain or more.

An enclosure suitable for fumigation may be formed by covering bulk or packaged commodity with poly sheeting. The sheets may be taped together to provide a sufficient width of material to ensure that adequate sealing is obtained. If the material rests on soil or flooring of wood or other porous material, it should be repositioned onto poly prior to covering for fumigation. The plastic covering of the pile may be sealed to the floor using sand or water snakes, by shoveling soil or sand onto the ends of the plastic covering or by other suitable procedures. The poly covering should be reinforced by tape or other means around any sharp corners or edges in the stack so as to reduce the risk of tearing. Use plastic sheeting or tarpaulins of at least 4 mil thickness. Thicker poly sheeting is recommended to reduce the potential for loss of fumigant.

Place warning placards at conspicuous points on the enclosure.

Pellets or tablets may be applied to the tarped stack or bunker storage of bulk commodity through slits in the poly covering. Probing or other means of dosing may be used. Avoid application of large amounts of Phostoxin® at any one point. It should be added below the surface of the commodity if condensation or other source of moisture is likely to form beneath the sheeting. The slits in the covering should be carefully taped to prevent loss of gas once the dose has been applied. Phostoxin® Prepacs are recommended for the treatment of bagged commodities and processed foods although pellets or tablets on trays or sheets of Kraft paper may also be used. Pellets or tablets and their reacted residues must not come into contact with any processed food except that they may be added directly to processed brewer's rice, malt and corn grits used in the manufacture of beer. Care should be taken to see that the plastic sheeting is not allowed to cover the Phostoxin® and prevent contact with moist air or confine the gas. Distribution of hydrogen phosphide gas is generally not a problem in the treatment of bagged commodities and processed foods. However, fumigation of larger bunker storages containing bulk commodities will require proper application procedures to obtain adequate results.

10.6.7 Fumigation of Railcars, Containers, Trucks, Vans and Other Transport Vehicles

Railcars and containers, trucks, vans and other transport vehicles shipped piggyback by rail may be fumigated in-transit. Aeration of railcars, railroad boxcars or shipping containers is prohibited en route.

It is not legal to move trucks, trailers, containers, vans, etc., over public roads or highways until they have been aerated and the warning placards removed.

Transport vehicles loaded with bulk commodities to which Phostoxin® tablets may be added directly are treated in essentially the same way as any other flat storage facility. Phostoxin® may be added as the vehicle is being filled, the dose may be scattered over

the surface after loading has been completed or the tablets may be probed below the surface. Carefully seal any vents, cracks or other leaks, particularly if the fumigation is to be carried out in-transit. See Section 8 of this Applicator's Manual for recommendations on placarding. Both doors of box cars should be placarded. Place fumigation warning placards on both sides of hopper cars near the ladders and atop the hatches to which Phostoxin® has been applied.

Written notification must be provided to the receiver of railcars, railroad boxcars, shipping containers and other vehicles that are being fumigated in transit. Notification must be made prior to the actual receipt of a fumigated vehicle or container by a consignee. A copy of the applicator's manual must precede or accompany all transportation containers or vehicles.

Phostoxin® Prepacs are recommended for the treatment of transport vehicles or similar storages containing processed foods for which no direct contact is allowed with pellets or tablets.

Proper handling of treated railcars, containers and other transport vehicles shipped piggyback by rail, at their destination is the responsibility of the consignee. Upon receipt of the railcar, railroad boxcars, shipping containers and other vehicles, a trained person must perform the aeration process. The trained person must be provincially licensed or have other documented authorized training recognized by the province or territory and must be familiar with the properties of hydrogen phosphide fumigants, worker exposure limits, required personal protective equipment, symptoms and first aid treatment for hydrogen phosphide poisoning, and must know how to take gas concentration measurements. A training completion date must be logged and maintained in the employee's safety training record. Upon receipt of a fumigated commodity, it must be documented in writing that the monitoring has been conducted and that aeration has been completed.

Transfer without aeration:

Railcars, containers and other transport vehicles shipped piggyback by rail, containing commodities under fumigation may be transferred to a storage area without prior aeration. The consignee must:

1. Ensure that worker exposure levels are not exceeded and
2. Ensure that the storage area into which the unaerated railcar, container or transport vehicle shipped piggyback is transferred, is placarded if it contains more than 0.1 ppm hydrogen phosphide.

Transfer with aeration:

The consignee must:

1. Aerate the railcar, containers or other transport vehicles shipped piggyback by rail, containing commodities under fumigation and verify that it contains no more than 0.1 ppm hydrogen phosphide.
2. Remove the fumigation warning placard after aeration is completed.
3. Ensure that worker safety limits have not been exceeded.
4. Transfer the fumigated commodity from the railcar, or containers and other transport vehicles shipped piggyback.
5. Dispose of spent fumigant.

10.6.8 Fumigation of Ships

10.6.8.1 General Information

1. **IMPORTANT:** Shipboard, in-transit ship or shiphold fumigation is also governed by Transport Canada Ship Safety Regulations. Refer to and comply with those Regulations and Ship Safety Bulletins prior to fumigation. In Canada, fumigations must be carried out under the direction of a “Fumigator-in-Charge” as indicated in these regulations.

No person shall fumigate in-transit or permit in-transit fumigation in a Canadian flag ship. The decision to fumigate-in-transit on Non-Canadian flag vessels is at the discretion of the master (see Ship Safety Bulletin 13/93).

2. Phostoxin® pellets and tablets are classified as restricted use pesticides due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH₃) gas. These products are for retail sale to and use only by provincially licensed personnel for those uses covered by the applicator’s certification, or workers trained in accordance with the Applicator’s Manual and working under the direct supervision and in the physical presence of the certified applicator. (Physical presence means on site or on the premises). Read and follow the label and the Applicator’s Manual which contains complete instructions for the safe use of this pesticide.

10.6.8.2 Pre-Voyage Fumigation Procedures

1. Before fumigation is commenced, a notification of intention to fumigate must be given to the nearest Transport Canada Ship safety office (generally, no less than 24 hours in advance). Similarly, a notice must be given for vessels in-transit of Canadian waters and stopping at a Canadian Port. Prior to fumigating a vessel for in-transit cargo fumigation, the master of the vessel, or his/her representative, and the fumigator must determine whether the vessel is suitably designed and configured so as to allow for safe occupancy by the ship’s crew throughout the duration of the fumigation. If it is determined that the design and configuration of the vessel does not allow for safe occupancy by the ship’s crew throughout the duration of the fumigation, then the vessel must not be fumigated unless all crew members are removed from the vessel. The crew members must not be allowed to reoccupy the vessel until the vessel has been properly aerated to 0.1 ppm or below and a determination has been made by the master of the vessel and the fumigator that the vessel is safe for occupancy.
2. The person responsible for the fumigation must notify the master of the vessel, or his/her representative, of the requirements: 1) relating to the use of personal respiratory protection equipment*; 2) relating to the use of detection equipment; and 3) that a person qualified in the use of this equipment must accompany the vessel with cargo under fumigation. Emergency procedures, cargo ventilation, periodic monitoring and inspections, and first aid measures must be discussed with and understood by the master of the vessel or his/her representative.

*Personal respiratory protection means a NIOSH/MSHA approved air purifying full face gas-mask with a chin style mounted canister

approved for phosphine OR a NIOSH/MSHA approved supplied-air respirator with a full face piece for phosphine levels up to 5 ppm. A self-contained breathing apparatus (SCBA) must be worn and operated in a positive pressure mode when phosphine levels are above 5 ppm or at unknown concentrations.

3. Seal all openings to the cargo hold or tank and lock or otherwise secure all openings, manways, etc., which might be used to enter the hold. The overspace pressure relief system of each tank aboard tankers must be sealed by closing the appropriate valves and sealing the openings into the overspace with gas-tight materials.
4. Placard all entrances to the treated spaces with fumigation warning signs as described in Sec. 8 of this Applicator's Manual. A watchman must be posted at the gangway to keep unnecessary persons from boarding.
5. If the fumigation is not completed and the vessel aerated before the manned vessel leaves port, the Fumigator-in-Charge shall ensure that there be on board the vessel during the voyage: 1) at least four NIOSH/MSHA approved self-contained breathing apparatus (SCBA)* and four additional air bottles or combination supplied-air respirators; 2) two gas detection devices (when these devices require re-arming after use, the ship shall be equipped with 10% more spare tubes than are required to conduct the required testing for the duration of the voyage); and 3) a person qualified in their operation. If the fumigated area of the vessel has to be re-entered before complete aeration, approved respiratory protection must be worn.

*The total number of SCBA on board a vessel need not exceed 6, including those already on board for fire fighting, etc. and required by other regulations.

6. During fumigation, the Fumigator-in-Charge shall ensure that a qualified person using gas or vapour detection equipment routinely tests spaces adjacent to spaces containing fumigated cargo and all regularly occupied spaces for fumigant leakage. For fumigation-in-transit, the vessel must remain alongside for a minimum of 24 hours, or the Fumigator-in-Charge must sail with the ship and remain on board for a minimum of 24 hours once fumigation has commenced. If leakage of the fumigant is detected, the person in charge of the fumigation shall take action to correct the leakage, or shall inform the master of the vessel, or his/her representative, of the leakage so that corrective action can be taken. At the end of the 24 hour period, final gas readings should be made and a clearance certificate issued.
7. Review with the master, or his/her representative, the precautions and procedures for during the voyage. Clear written instructions must be given to the master of the ship, to the receiver of the cargo and to the authorities at the discharging port as to how any powdery residues are to be disposed of.

10.6.8.3 Application Procedures for Bulk Dry Cargo Vessel and Tankers

Apply pellets or tablets by scattering uniformly over the commodity surface, or they may be shallow or deep probed into the commodity mass.

Immediately after application of the fumigant, close and secure all hatch covers, tank tops, butterworth valves, manways, etc.

10.6.8.4 **In Transit Fumigation of Containers Aboard Ships**

In transit fumigation of containers on ships is also governed by Transport Canada Ship Safety Regulations. Refer to and comply with these regulations prior to fumigation.

No fumigation of containers is to be commenced while the unit is on board a ship. The vessel Master must be notified and correct procedures regarding shipping documents, placarding and transport and stowage of containers under fumigation must be observed.

Application procedures for fumigation of raw commodities or processed foods in containers and other transport vehicles are described in Section 9.6.7.

10.6.8.5 **Precautions and Procedures During Voyage**

Using appropriate gas detection equipment, routinely monitor spaces adjacent to areas containing fumigated cargo and all regularly occupied areas for fumigant leakage. If leakage is detected, the area should be evacuated of all personnel, ventilated, and action taken to correct the leakage before allowing the area to be re-occupied.

Do not enter fumigated areas except under emergency conditions. If necessary to enter a fumigated area, appropriate personal respiratory protection equipment must be used. Never enter fumigated areas alone. At least two persons wearing the required breathing apparatus should enter, and at least one other person, wearing personal respiratory protection equipment, should be available to assist in case of an emergency.

10.6.8.6 **Precautions and Procedures During Discharge**

If necessary to enter a treated area prior to discharge, test spaces directly above grain surface for fumigant concentration, using appropriate gas detection and personal safety equipment. Do not allow entry to fumigated areas without personal safety equipment, unless fumigant concentrations are at or below 0.1 ppm, as indicated by a suitable detector.

10.6.9 **Fumigations in Small Sealable Enclosures**

Excellent results may be attained in the treatment of small enclosures since it is often possible to control the temperature during fumigation and also to make the enclosure virtually gas tight. Take care not to overdose during these fumigations. A single Phostoxin® pellet will treat a space of from 0.04 - 0.28 m³ (1.4 to 10 cubic feet). [From 0.19 - 1.42 m³ (6.9 to 50 cubic feet) may be fumigated with a single Phostoxin® tablet].

11. **AERATION OF FUMIGATED COMMODITIES**

11.1 **Foods and Feeds**

Many pesticidal chemicals are poisonous and may leave a toxic residue in the area to which they are applied. Health Canada has established maximum residue limits of such pesticidal chemicals that may remain on raw agricultural products, animal feeds and processed foods. **To guarantee**

compliance with these tolerances, it is necessary to aerate these commodities for 48 hours prior to offering them to the end consumer. It is the user's responsibility to see that there is no residue on such crops in excess of these amounts. The instructions in this Applicator's Manual are based on the best available information, and if followed carefully, should not leave excessive residues.

11.2 Tobacco

Tobacco must be aerated for at least three days (72 hours) when fumigated in hogsheads and for at least two days (48 hours) when fumigated in other containers. Tobacco fumigated in containers with plastic liners will probably require longer aeration periods to reach 0.1 ppm.

12. STORAGE INSTRUCTIONS

1. Store Phostoxin® in a dry, well ventilated area away from heat, under lock and key. Post as a pesticide storage area. Do not contaminate water, food or feed by storing pesticides in the same areas used to store these commodities.
2. Do not store in buildings where humans or domestic animals reside. Keep out of reach of children.
3. Phostoxin® pellets and tablets are supplied in gas-tight, resealable aluminum flasks. Do not expose the product to atmospheric moisture any longer than is necessary and seal tightly before returning opened flasks to storage.
4. The shelf life of Phostoxin® is virtually unlimited as long as the containers are tightly sealed.

13. DISPOSAL

13.1 General

Pesticide wastes are toxic. Open dumping is prohibited. Do not discharge this product, or material containing this product, into natural waterways, wetlands (swamps, bogs, marshes, potholes, etc.) or municipal wastewater collection systems. Proper disposal of aluminum phosphide is required to ensure minimal impact on the environment.

Unreacted or partially reacted aluminum phosphide is acutely hazardous. If these wastes cannot be disposed of according to label instructions, contact the Provincial Regulatory Agency or the Manufacturer. See also Section 14 of this manual, Spill and Leak Procedures.

13.2 Product Container Disposal

The container must be cleaned prior to disposal. There are two options: 1) Triple rinse empty flasks and stoppers with water. Dispose of rinsate in a sanitary landfill, by pouring it out onto the ground or by other approved procedures. 2) Remove lids and expose empty flasks to atmospheric conditions until residue in the flasks is reacted. This should be done outdoors, away from inhabited buildings.

Once the container is clean, it may be offered for recycling or reconditioning. Alternatively, it may be made unsuitable for further use and disposed of in a sanitary landfill, or by other procedures approved by provincial and local authorities.

13.3 Disposal of Spent Residual Dust from Phostoxin®

- 13.3.1 **Do not use these directions for incompletely exposed residual dust. See Section 13.4.** If properly exposed, the residual dust remaining after a fumigation with Phostoxin® will be a greyish-white powder. This will be a nonhazardous waste and contain only a small amount of unreacted aluminum phosphide.

13.3.2 Spent residual dust from Phostoxin® should be collected and disposed of at a sanitary landfill, incinerator or other approved sites.

13.3.3 From 2 to 3 kg (4 to 7 lbs.) of spent dust of Phostoxin® may be collected for disposal in a 4 litre bucket. Larger amounts may be collected in burlap, cotton or other types of porous cloth bags for transportation in an open vehicle to the disposal site. Do not collect dust from more than about 11 kg (25 lbs.) of product in a single bag. Do not pile cloth bags together.

Caution: Do not collect dust in large drums, dumpsters, plastic bags or other containers where confinement may occur.

13.4 Deactivation of Partially-Spent Residual Dust from Phostoxin®

13.4.1 There are two forms of partially-spent residual dust. The most volatile of these is called “green dust”, due to its grey-green colour. “Green dust” can result when Phostoxin® has not been exposed to the atmosphere for the recommended period of time (e.g. when a fumigation is aborted after only 8 hours because the temperature has dropped below 5°C).

A second form of partially-spent residual dust can occur when Phostoxin® is exposed under low temperature or humidity conditions. There may be some unreacted aluminum phosphide remaining in the dust, even if the product was exposed for the recommended period of time. Under these circumstances, the residual dust will have a grey-almost white appearance.

Partially spent dust must be further deactivated prior to ultimate disposal. This is especially true in the cases where “green dust” is present, or following a fumigation which has produced large quantities of partially spent material.

Caution: Confinement of partially spent residual dust, as in a closed container, or collection and storage of large quantities of dust may result in a fire hazard. Small amounts of hydrogen phosphide may be given off from unreacted aluminum phosphide, and confinement of the gas may result in a flash.

13.4.2 Extension of the fumigation period is the simplest method for further deactivation of “green” or partially spent dust prior to ultimate disposal.

13.4.3 “Green” or partially spent residual dust from Phostoxin® may be deactivated as follows using the “Dry Method”.

Small amounts of partially spent dust, from 2 to 3 kg (4 to 7 lbs.) may be deactivated by storage in a 4 litre bucket. Dust should be deactivated outdoors, in a dry location away from inhabited buildings. Larger amounts of dust (about 11 kg or 25 lbs.) may be held for deactivation in porous cloth bags (burlap, cotton, etc.). **Caution: Do not use cloth bags for the deactivation of “green dust”.**

Placards should be posted, and the site secured to prevent unauthorized persons from tampering with the deactivating dust.

Once deactivated, the dust may be disposed of at an approved sanitary landfill. Caution: Transport the dust in open vehicles without stacking the buckets or piling the bags.

13.4.4 “Green” or residual dust from Phostoxin® may also be deactivated as follows using the “Wet Method”:

Caution: Wear appropriate respiratory protection during wet deactivation of partially spent material. Do not cover the container being used for wet deactivation. This procedure should be performed in the open air and not in the fumigated structure.

Deactivating solution is prepared by adding the appropriate amount of low-sudsing detergent or surface active agent to water in a drum or other suitable container. A 2% solution (2000 ml in 100 litres) is suggested. The container should be filled with deactivating solution to within 5-7 cm of the top.

Residual dust is poured **slowly** into the deactivating solution and stirred so as to thoroughly wet all of the particles. Dust from Phostoxin® pellets or tablets should be mixed into no less than about 40 litres of water/detergent solution for each case (21 kg) of material used. Fill the drum with additional water to eliminate headspace.

Placards should be posted, and the site secured to prevent unauthorized persons from tampering with the drums. Allow the suspension to stand for 36 hours or more. Dispose of the deactivated dust/water suspension, with or without preliminary decanting, at an approved sanitary landfill. The deactivating solution may be poured onto the ground. Avoid direct pouring into a storm sewer.

14. SPILL AND LEAK PROCEDURES

14.1 General Precautions and Directions

This product is highly toxic to fish, birds, and other forms of wildlife. Do not discharge directly to natural waterways, wetlands (swamps, bogs, marshes, potholes, etc.) or municipal wastewater collection systems. Do not contaminate water, food or feed by disposal. Proper disposal of aluminum phosphide is required to ensure minimal impact on the environment. Contact the manufacturer and the provincial regulatory agency in case of a spill, and for clean-up of spills.

A spill, other than incidental to application or normal handling, may produce high levels of gas. When the concentration of hydrogen phosphide gas is 5 ppm or higher, or when the concentration of the gas is unknown, attending personnel must wear a NIOSH/MSHA approved SCBA, operated in a positive pressure mode. An approved supplied-air respirator with a full face piece or full-face gas mask with a phosphine canister may be worn if the level of gas is determined to be below 5 ppm. Wear dry gloves of cotton or other breathable material when handling aluminum phosphide.

Do **not** use water at any time to clean up a spill of Phostoxin®. Liquids in contact with unreacted pellets or tablets will greatly accelerate the production of hydrogen phosphide gas which could result in a toxic and/or fire hazard.

Return all intact aluminum flasks to fibreboard cases or other packaging which has been suitably constructed and marked according to T.D.G.A. regulations. Notify consignee and shipper of damaged cases.

If aluminum flasks have been punctured or damaged so as to leak, the container may be temporarily repaired with aluminum tape or the Phostoxin® may be transferred from the damaged flask to a sound metal container which should be sealed and properly labelled as aluminum phosphide. Transport the damaged containers to an area suitable for pesticide storage for inspection. Further instructions and recommendations may be obtained from the manufacturer.

If a spill has occurred which is only a few minutes old, collect the pellets or tablets and place them back into the original flasks, if they are intact, and stopper tightly. Place the collected

pellets or tablets in a sound metal container if the original flasks are damaged. **Caution, these flasks may flash upon opening at some later time. When possible, open flasks outdoors. Do not open flasks in an explosive environment (e.g. flour mill).**

If the age of the spill is unknown, or if the pellets or tablets have been contaminated with soil, debris, water, etc., gather up the spillage and place it into small open buckets having a capacity no larger than about 4 litres. Do not add more than about 1 to 1.5 kg (2 to 3 lbs.) to the bucket. If on-site deactivation is not feasible, these open containers should be transported in open vehicles to a suitable area. Wet deactivation may then be carried out as described in 13.2.

14.2 Deactivation of Phostoxin® by the Wet Method

This is similar to the Sec. 12.4.4 (Wet deactivation of partially-spent residual dust). The differences are that more water is required, and that any water which bubbles out of the drum is replaced.

14.2.1 **Caution: Wear appropriate respiratory protection during wet deactivation of unexposed or incompletely exposed Phostoxin®. Never place pellets or tablets or dust in a closed container such as a dumpster, sealed drum, plastic bag, etc., as flammable concentrations and a flash of hydrogen phosphide gas are likely to develop.**

14.2.2 Deactivating solution is prepared by adding the approximate amount of low-sudsing detergent or surface active agent to water in a drum or other suitable container. A 2% solution (2000 ml in 100 litres) is suggested. The container should be filled with deactivating solution to within 5-7 cm of the top.

14.2.3 **Add pellets or tablets to the deactivating solution slowly.** Stir to thoroughly wet all of the product. This procedure should be done in the open air. Pellets or tablets should be mixed into no less than 57 litres of water/detergent solution for each case (21 kg) of material to be deactivated. Fill the drum with additional water to eliminate headspace.

14.2.4 Keep a water supply on hand to top-up the drum as necessary. Placards should be posted, and the site secured to prevent unauthorized persons from tampering with the drums. Allow the mixture to stand, with occasional stirring, for 36 hours. The resultant slurry will then be safe for disposal.

14.2.5 Dispose of the slurry of deactivated material, with or without preliminary decanting, at an approved sanitary landfill. The deactivating solution may be poured onto the ground. Do not dispose of dust, slurry or deactivated solution by direct addition to sanitary or storm sewers.

FOR ASSISTANCE, CONTACT:

DEGESCH AMERICA, INC.
153 Triangle Drive
P. O. Box 116
Weyers Cave, VA 24486 USA
Telephone: 540-234-9281/800-330-2525
Fax: 540-234-8225
Internet: www.degeschamerica.com
E-Mail: degesch@degeschamerica.com

OR

GARDEX CHEMICALS LTD.
7 Meridian Road
Etobicoke, Ontario
Canada M9W 4Z6
Telephone: 416-675-1638
Fax: 416-798-1647

OR

HOT LINE NUMBER

Have the product container label or Applicator's Manual with you when calling a poison control centre, doctor, or when going for treatment. **CONTACT 1-800-308-4856 FOR ASSISTANCE WITH HUMAN OR ANIMAL MEDICAL EMERGENCIES.** You may also contact DEGESCH AMERICA, INC. 540-234-9281/1-800-330-2525 or, GARDEX CHEMICALS, LTD. 416-675-1638. For all other chemical emergencies, please contact CHEMTREC – 1-800-424-9300 or Canadian Transport Emergency Centre (CANUTEC) 613-996-6666.