

**APPLICATOR'S MANUAL  
FOR**



**DEGESCH PHOSTOXIN® PREPAC ROPE**

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

**RESTRICTED**

**DANGER**



**POISON**

**KEEP OUT OF REACH OF CHILDREN**

**GUARANTEE:** Aluminum Phosphide 55%

**READ THE ENTIRE LABEL AND THIS APPLICATOR'S MANUAL  
BEFORE USING**

**REGISTRATION NO. 20252 PEST CONTROL PRODUCTS ACT**

**EPA EST. NO. 40285-VA-01**

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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 TABLETS IN PHOSTOXIN® PREPAC ROPES 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 a 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

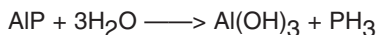
1.	<b>INTRODUCTION</b> .....	1
	<b>SAFETY RECOMMENDATIONS SUMMARY</b> .....	2
2.	<b>FIRST AID</b> .....	2
3.	<b>TOXICOLOGICAL INFORMATION</b> .....	4
4.	<b>PRECAUTIONS</b> .....	5
4.1	<b>DANGER: Hazardous to Humans, Domestic Animals and Nesting Birds</b> .....	5
4.2	<b>Physical and Chemical Hazards</b> .....	6
4.3	<b>Environmental Hazards</b> .....	6
5.	<b>PROTECTIVE CLOTHING</b> .....	7
6.	<b>RESPIRATORY PROTECTION</b> .....	7
6.1	<b>When Respiratory Protection Must Be Worn</b> .....	7
6.2	<b>Permissible Gas Concentration Ranges for Respiratory Protection Devices</b> .....	7
6.3	<b>Requirements for Availability of Respiratory Protection for outside applications</b> .....	8
7.	<b>APPLICATOR AND WORKER EXPOSURE</b> .....	8
7.1	<b>Hydrogen Phosphide Exposure Limits</b> .....	8
7.2	<b>Application of Fumigant</b> .....	8
7.3	<b>Leakage from Fumigated Sites</b> .....	9
7.4	<b>Aeration and Reentry</b> .....	9
7.5	<b>Handling Un-Aerated Commodities</b> .....	9
7.6	<b>Industrial Hygiene Monitoring</b> .....	9
8.	<b>PLACARDING OF FUMIGATED AREAS</b> .....	10
9.	<b>DIRECTIONS FOR USE</b> .....	11
9.1	<b>General</b> .....	11
9.2	<b>Pests Controlled</b> .....	14
9.3	<b>Exposure Conditions</b> .....	15
9.4	<b>Commodities Which May be Fumigated with Phostoxin®</b> .....	16
9.4.1	<b>Raw Agricultural Commodities, Animal Feeds &amp; Processed Foods</b> .....	16
9.4.2	<b>Non-Food Commodities, Including Tobacco</b> .....	16
9.5	<b>Recommended Dosages</b> .....	17
9.6	<b>Application Procedures</b> .....	18
9.6.1	<b>Fumigation of Mills, Food Processing Plants and Warehouses</b> .....	19
9.6.2	<b>Fumigation of Flat Storages, Bunkers, Farm Storages, Vertical Storages</b> .....	20

9.6.3	<b>Bunker and Tarpaulins Fumigations</b> .....	20
9.6.4	<b>Fumigation of Railcars, Containers, Trucks, Vans and Other Transport Vehicles</b> .....	21
9.6.5	<b>Fumigation of Ships</b> .....	23
9.6.5.1	<b>General Information</b> .....	23
9.6.5.2	<b>Pre-Voyage Fumigation Procedures</b> .....	24
9.6.5.3	<b>Application Procedures for Bulk Dry Cargo Vessels &amp; Tankers</b> .....	26
9.6.5.4	<b>In Transit Fumigation of Containers Aboard Ships</b> .....	26
9.6.5.5	<b>Precautions and Procedures During Voyage</b> .....	26
9.6.5.6	<b>Precautions and Procedures During Discharge</b> .....	27
10.	<b>AERATION OF FUMIGATED COMMODITIES</b> .....	27
10.1	<b>Foods and Feeds</b> .....	27
10.2	<b>Tobacco</b> .....	27
11.	<b>STORAGE INSTRUCTIONS</b> .....	27
12.	<b>DISPOSAL</b> .....	28
12.1	<b>General</b> .....	28
12.2	<b>Product Container Disposal</b> .....	28
12.3	<b>Disposal of Phostoxin® Prepac Ropes</b> .....	28
12.4	<b>Deactivation of Incompletely Reacted Prepac Ropes</b> .....	29
13.	<b>SPILL AND LEAK PROCEDURES</b> .....	31
13.1	<b>General Precautions and Directions</b> .....	31
13.2	<b>Deactivation of Phostoxin® by the Wet Method</b> .....	32

## 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, PH<sub>3</sub>) 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.

The Phostoxin Prepac Rope is a gas-permeable blister pack, porous on both sides, containing 1056 Phostoxin Round Tablets. The Rope measures roughly (20.32 cm) 8 inches wide by (6.55 meters) 21.5 feet long and is composed of 32 interconnected Phostoxin Tablet Prepacs, each Prepac containing 33 round tablets. The Tablet Prepacs are approximately (10.16 cm x 40.6 cm) 4 by 16 inches and are arranged in 16 rows of 2 Prepacs abreast in the Rope. The standard Prepac Rope will liberate 1056g of hydrogen phosphide gas, although they may be special made in smaller or larger sizes. The Phostoxin Prepac Ropes are packed in gas-tight, (24.6 liters) 6.5 gallon metal pails, 2 Ropes per pail.

Upon opening the steel pail, atmospheric moisture penetrates the porous fleece material on the top and bottom of the Phostoxin Prepac Rope. The Phostoxin tablets then begin to react to produce small quantities of hydrogen phosphide gas which diffuses out through the fleece into the surrounding space. This reaction starts slowly, gradually accelerates and then tapers off again as the aluminum phosphide is spent. The rate of decomposition of the Prepac Rope 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 powder will be retained inside the fleece of the Prepac Rope and may be retrieved after the fumigation so as not to contaminate the treated commodity. If properly exposed, the spent Phostoxin Prepac Rope 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 Prepac Ropes are supplied in resealable gas-tight containers and their shelf life is unlimited as long as the packaging remains intact. Do not expose Ropes to the atmosphere any longer than is necessary prior to application. Storage and handling instructions will be given in detail later in the Applicator's Manual.

A summary of safety recommendations is outlined below:

### **SAFETY RECOMMENDATIONS SUMMARY**

1. Carefully read the labeling 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 a 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. It is not necessary to wear gloves or other protective clothing when handling Phostoxin Prepac Ropes. However, wear dry gloves of cotton or other breathable material if contact with Phostoxin Tablets, Pellets or dust is likely. Wash hands thoroughly after using Phostoxin. Aerate used gloves and other contaminated clothing in a well ventilated area prior to laundering.
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. Containers may be opened inside the structure to be fumigated provided the worker's exposure to hydrogen phosphide gas does not exceed allowable limits.
7. Exposure to hydrogen phosphide must never exceed the eight hour Time-Weighted Average (TWA) of 0.3 ppm or the 15 minute Time-Weighted Short-Term Exposure Limit (STEL) of 1.0 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 Ropes 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 0.3 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 0.3 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 may corrode metals at high concentrations or humidities. Protection or removal of wiring, sensitive equipment or precious metals is recommended under these conditions.
18. Phostoxin Prepac Ropes may be used for the fumigation of packaged goods, processed foods and other commodities where direct contact with Phostoxin or its reacted residue is illegal or not desired. Under no circumstances shall food, feed and/or raw agricultural commodities that may be used directly as food come into contact with aluminum phosphide.
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 overexposure are headache, dizziness, nausea, difficult breathing, vomiting, and diarrhea. In all cases of overexposure, get medical attention **IMMEDIATELY**. Take victim to a doctor, emergency treatment facility or poison control centre, bringing this Applicator's Manual. Take container label or product name and Pest Control Product Registration Number with you when seeking medical attention.

### **If the gas or dust from Phostoxin® is inhaled:**

Get exposed person to fresh air. Keep warm and make sure person can breathe freely. If breathing has stopped, call 911, give artificial respiration by mouth-to-mouth or other means of resuscitation. Do not give anything by mouth to an unconscious person. Call a poison control centre or doctor immediately for further treatment advice.

### **If Phostoxin® tablets or dust are swallowed:**

Induce vomiting by touching back of throat with finger. Do not give anything by mouth if victim is unconscious or not alert. Contact physician or poison control centre immediately.

**If dust or granules from Phostoxin® get 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 dust from tablets gets 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 or dust will react with moisture from the air, acids and many other liquids to release hydrogen phosphide (phosphine, PH<sub>3</sub>) 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. Treatment is symptomatic.

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](http://www.croplife.ca)

Aluminum phosphide from Phostoxin® or its partially spent 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, PH<sub>3</sub>) which is an extremely toxic gas. If a garlic odour is detected, refer to the information on Industrial Hygiene Monitoring (Section 7.6) 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 Phostoxin® Prepac Ropes 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.

Always open containers of aluminum phosphide products in open air, as under certain conditions, they may flash upon opening. When opening, point the container away from the face and body. 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, marsh-

es, streams, reservoirs and wetlands by cleaning of equipment or disposal of wastes.

## 5. **PROTECTIVE CLOTHING**

It is not necessary to wear gloves or other protective clothing when handling Phostoxin Prepac Ropes. However, wear dry gloves of cotton or other breathable material if contact with Phostoxin Tablets, Pellets or dust is likely. Wash hands thoroughly after using Phostoxin. 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<sub>3</sub>) detector tubes may be obtained from your distributor.

### 6.2 **Permissible Gas Concentration Ranges for Respiratory Protection Devices**

For hydrogen phosphide levels between 0.3-15 ppm, the minimum protection required is a NIOSH/MSHA approved air-purifying full-face gas mask with a chin style, front- or back- mounted canister approved for phosphine OR any NIOSH/MSHA approved self-contained breathing apparatus with a full facepiece. For hydrogen phosphide levels up to 50 ppm, any

NIOSH/MSHA approved supplied-air respirator with a full facepiece and is operated in a positive pressure mode may be worn. In situations where the hydrogen phosphide concentration is unknown, or to escape from conditions which are Immediately Dangerous to Life or Health (IDLH), a NIOSH/MSHA approved self-contained breathing apparatus (SCBA) with a full facepiece 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, 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 the eight hour Time-Weighted Average of 0.3 ppm or the 15 minute Time-Weighted Average Short-Term Exposure Limit (STEL) of 1.0 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® Prepac Rope releases hydrogen phosphide gas slowly upon exposure to moisture from the air. If the fumigator's exposure exceeds the eight hour TWA of 0.3 ppm, or the STEL of 1.0 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 0.3 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 eight-hour Time-Weighted-Average of 0.3 ppm or the 15 minute Time-Weighted Short-Term Exposure Limit (STEL) of 1.0 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.

If monitoring shows that workers are exposed to concentrations in excess of the permitted limits, then engineering controls (such as forced air ventilation) and/or appropriate work practices should be used, where possible, to reduce exposure to within permitted limits.

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, PH<sub>3</sub>) 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 0.3 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 0.3 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 0.3 ppm hydrogen phosphide or less. To determine whether aeration is complete, each fumigated site or vehicle must be monitored and shown to contain 0.3 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. DIRECTIONS FOR USE

### 9.1 General

9.1.1 The use of Phostoxin® Prepac Ropes is restricted due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH<sub>3</sub>) 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.

9.1.2 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: 540-234-9281/800-330-2525  
Fax: 540-234-8225  
Internet: [www.degeschamerica.com](http://www.degeschamerica.com)  
E-Mail: [degensch@degeschamerica.com](mailto:degensch@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.

- 9.1.3 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.

- 9.1.4 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.

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

- 9.1.6 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.

- 9.1.7 It is not necessary to wear gloves or other protective clothing when handling Phostoxin Prepac Ropes. However, wear dry gloves of cotton or other breathable material if contact with Phostoxin Tablets, Pellets or dust is likely. Wash hands thoroughly after using Phostoxin.

- 9.1.8 Phostoxin® Prepac Ropes must be removed for disposal at the end of the fumigation period.

- 9.1.9 Although both sides of the Prepac Rope are porous, it is recommended that they be applied with the rounded fleece blisters contacting the floor, tarpaulin, or flat surface of the material to which they are mounted. This will provide for maximum access of air to the Phostoxin tablets. The Prepac Ropes may also be probed below the surface of bulk feed or raw agricultural commodity if they are carefully secured and marked for easy retrieval after the exposure period.
- 9.1.10 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.
- 9.1.11 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.
- 9.1.12 Piling of tablets, pellets, or bags or the addition of liquid to the product is prohibited.
- 9.1.13 The metal pails in which the Prepac Ropes are packaged are resealable and may be returned to storage after they have been opened. Do not expose Ropes to the atmosphere any longer than is necessary prior to application.
- 9.1.14 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.
- 9.1.15 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.
- 9.1.16 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 15 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 15 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.

- 9.1.17 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.

## 9.2. Pests Controlled

Phostoxin® has been found effective against the following 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	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** Prepac Rope. 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.

### 9.3 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.

During periods of colder weather, the temperature of the commodity and insects may be significantly higher than the temperature to which the Prepac Rope is exposed. It is often possible under these conditions to obtain satisfactory control of pests before the Rope is totally spent. In these cases, it is permissible to conclude the fumigation as soon as effective control has been achieved. However, partially spent Prepac Ropes must be further deactivated prior to disposal. See Directions for Deactivation of Incompletely Reacted Phostoxin Prepac Ropes (Section 12.4).

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.

## 9.4 **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.

### 9.4.1 **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® Prepac Ropes 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.

### 9.4.2 **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

Psyllium Seed and Psyllium Seed Husks Intended for Drug Use\*

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.

\*Only lots of psyllium seed and psyllium seed husks destined for shipment to pharmaceutical manufacturers may be fumigated. Such dedicated lots may be fumigated in transport vehicles (truck trailers, railcars, containers) prior to shipment. In addition, psyllium seed and husks may be fumigated at other locations only under direct instructions, from the pharmaceutical company.

## 9.5 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 364 kL (10,000 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 allowable dosage range is one Prepac Rope (1056g of hydrogen phosphide) per 200-1500 m<sup>3</sup>. Note: The maximum dosage for dates and dried fruits and nuts is one Prepac Rope per 750 m<sup>3</sup>. This dosage is not to be exceeded. It is important to be aware that a shortened exposure period cannot be fully compensated by an increased dosage of hydrogen phosphide.

The wide range of dosages listed below 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

	Volume Range Per Rope (cubic metres)
1. Space mills, warehouses, etc. bagged commodities processed dried fruits and nuts stored tobacco	500-1500 500-1000 750-1500 750-1500
2. Bulk Stored Commodities vertical storages tanks flat storages (loose construction) farm bins bunkers & tarped ground storages railcars shipholds	500-1000 425-1000 200- 600 200- 425 370-1000 460-1000 450-1000

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.

### 9.6 Application Procedures

Listed commodities may be fumigated in bulk, in bags or in packages under gas-proof tarpaulins, in warehouses, silos, bins, flat stores, ships, or in other sealable enclosures where they are stored commercially and which can be made sufficiently gas tight. They may also be fumigated in sealed box or hopper cars and containers or other transport vehicles shipped piggyback by rail (static or rolling). Do not move trucks, trailers, containers, vans, etc., over public roads or highways until they have been aerated and the warning placards removed.

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

**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:

#### **9.6.1 Fumigation of Mills, Food Processing Plants and Warehouses**

1. Using the label, calculate the duration of the fumigation and the dosage of Prepac Ropes 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. Apply the Prepac Ropes throughout the area to be treated. Ropes are usually applied to the floor; however, they may be laid atop the commodity or other suitable surface. Although the Prepac Ropes may be applied with either side up, it is generally recommended that they be mounted with the rounded fleece blisters down on the flat surface since this will allow for optimum contact with air. Take care that the Ropes are not allowed to pile up so as to restrict access of air to the porous fleece. Do not apply Ropes in areas where they may be contacted by liquid water from condensate, leaking pipes, rain, etc.
4. Doors leading to the fumigated space should be closed, sealed, locked and placarded with warning signs.
5. The fumigation period usually lasts from 3 to 5 days depending upon the temperature and humidity. 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 gas concentration is 0.3 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 for monitoring requirements during application of fumigant and reentry.
6. Collect the spent Phostoxin® Prepac Ropes for disposal, with or without further deactivation, following recommendations given under **Disposal Instructions**.
7. Remove fumigation warning placards only after aeration is complete (See Sec. 8, Placarding of Fumigated Areas).

## 9.6.2 **Fumigation of Flat Storages, Bunkers, Farm Storages, Vertical Storages**

**Phostoxin®** Prepac Ropes are intended primarily for application at or near the surface of the commodity to be treated. The Prepac Ropes may be applied directly atop the commodity or they may also be placed below the surface by probing or trenching if they can be anchored and marked for easy retrieval after completion of the exposure period. Surface application may be used if the storage can be made sufficiently gas tight to contain the fumigant gas long enough for it to penetrate the commodity. This procedure is not recommended for leaky structures or when a considerable depth of bulk commodity must be penetrated to assure effective gas concentrations in all parts of the storage. In these instances, it is advisable to place about 25 percent of the dosage in the floor level aeration ducts. This may be made in the form of **Phostoxin®** tablets or pellets. Check the ducts prior to addition of **Phostoxin®** to make sure that they contain no liquids.

Tarping of the surface of the commodity is often advisable, particularly if the overhead of the storage cannot be well sealed. Use plastic sheeting or tarpaulins of at least 4 mil thickness. Thicker poly sheeting, 20 mil or greater, is recommended to reduce the potential for loss of fumigant.

Close and lock all entrances to the storage and post fumigation warning placards.

## 9.6.3 **Bunker and Tarpaulin Fumigations**

When possible, conduct tarpaulin fumigations outside. Do not contaminate natural waterways, wetlands (swamps, bogs, marshes, potholes, etc.) or municipal wastewater collection systems.

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 meters, 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 repo-

sitioned on poly prior to covering for fumigation. The plastic covering of the pile may be sealed to the floor using sand or water snakes, by shovelling 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.

Ropes may be applied to the tarped stack or bunker storage of bulk commodity through slits in the poly covering. The Rope may be applied with either side up although application with the rounded fleece blisters contacting the tarp will often result in better air flow to the tablets and more complete breakdown. Avoid application of large numbers of **Phostoxin®** Prepac Ropes at any one point. The Ropes should be placed away from areas where 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. 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 commodity will require proper application procedures to obtain adequate results.

Excellent results may be attained in the treatment of small enclosures or structures 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 Prepac from the Rope will treat a space of from 6.5 to 46.7 m<sup>3</sup>.

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.

#### 9.6.4 **Fumigation of Railcars, Containers, Trucks, Vans and Other Transport Vehicles**

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

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.

Care must be taken to seal all doors, hatches, vents, cracks or other leaks, particularly if the fumigation is to be carried out in-transit. **Phostoxin®** Prepac Ropes may be applied directly atop the surface of the commodity. If the fumigation is to be performed in-transit, the Ropes must be secured to prevent them from shifting during the voyage. They may also be applied in trenches or gently stepped onto the commodity. Take care to ensure that the Ropes are spread out and are applied at least several feet apart. Do not apply the Ropes in areas where contact with liquid water is likely.

Although the Prepac Ropes may be applied with either side up, it is generally recommended that they be mounted with the rounded fleece blisters facing up, since this will allow for optimum contact with air. If poly is applied to seal the hatch cover, do not allow it to sag and cover the Prepac Rope.

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.

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 main-

tained 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.

Aeration of railcars, railroad boxcars or shipping containers is prohibited en route.

The consignee must:

1. aerate the railcar and verify that it contains no more than 0.3 ppm hydrogen phosphide.
2. remove the fumigation warning placard.
3. ensure that worker safety limits have not been exceeded.
4. transfer the fumigated commodity from the railcar with or without prior aeration.

### 9.6.5 Fumigation of Ships

#### 9.6.5.1 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® Prepac Ropes are classified as restricted use pesticides due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH<sub>3</sub>) 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.

### 9.6.5.2 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 0.3 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.  
  
\*(See Respiratory Protection Section).
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.

### 9.6.5.3 **Application Procedures for Bulk Dry Cargo Vessel and Tankers**

1. DEGESCH **Phostoxin®** Prepac Ropes may be applied directly atop the surface of the commodity if they are secured to prevent them from shifting during the voyage. They may also be applied in trenches or gently stepped into the commodity.
2. Take care to ensure that the Ropes are spread out and are applied at least several feet apart. Do not apply the Ropes in areas where contact with liquid water is likely.
3. Immediately after application of the fumigant, close and secure all hatch covers, tank tops, butterworth valves, manways, etc.

### 9.6.5.4 **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 9.4.1.

### 9.6.5.5 **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.

#### 9.6.5.6 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 0.3 ppm, as indicated by a suitable detector.

### 10. AERATION OF FUMIGATED COMMODITIES

#### 10.1 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.

#### 10.2 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 0.3 ppm.

### 11. 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® Prepac Ropes are supplied in gas-tight, resealable 30 liter metal pails. Do not expose the product to atmospheric moisture any longer than is necessary and seal tightly before returning opened pails to storage.

4. The shelf life of Phostoxin® is virtually unlimited as long as the containers are tightly sealed and not damaged.

## 12. DISPOSAL

### 12.1 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. Do not contaminate water, food or feed by disposal. 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 13 of this manual, Spill and Leak Procedures.

### 12.2 Product Container Disposal

The container must be cleaned prior to disposal. There are two options: 1) Triple rinse empty pails and lids 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 pails and packaging to atmospheric conditions until residue 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.

### 12.3 Disposal of Spent Phostoxin® Prepac Ropes

12.3.1 **Do not use these directions for incompletely reacted Prepac Ropes. See Section 12.4.** 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.

12.3.2 Spent Phostoxin® Prepac Ropes should be collected and disposed of at a sanitary landfill, incinerator or other approved sites. Incompletely exposed Prepac Ropes must be further deactivated before disposal at a landfill.

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

## 12.4 Deactivation of Incompletely Reacted Phostoxin® Prepac Ropes

- 12.4.1 **Caution:** Confinement of partially spent Ropes may result in a fire hazard. Small amounts of hydrogen phosphide may be released from unreacted aluminum phosphide, and confinement of the gas can result in a flash. Do not collect partially spent Ropes in large drums, plastic bags, dumpsters or other containers where confinement may occur.
- 12.4.2 Ignition may occur if large numbers of incompletely reacted Prepac Ropes are contacted by liquids. This can occur in open or perforated storage containers. Therefore, such storage should be out of doors in a relatively isolated area protected from rain. Wire baskets, suitable for storage and further deactivation, may be obtained from DEGESCH America, Inc.
- 12.4.3 There are two forms of dust which can be present in partially-spent Prepac Ropes. The most volatile of these is called “green dust”, due to its grey-green colour. “Green dust” can result when Ropes have 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 dust can occur when Prepac Ropes are exposed under low temperature or humidity conditions. There may be some unreacted aluminum phosphide remaining in the Prepac Ropes, 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.

Incompletely reacted **Phostoxin®** Prepac Ropes 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.

- 12.4.4 Incompletely Reacted Prepac Ropes may be deactivated as follows:

**Phostoxin®** Prepac Ropes may be “dry deactivated” by storing the ropes in a locked, steel wire disposal basket or similar ventilated container. These baskets are available from DEGESCH America, Inc. The wire basket must be kept in a well ventilated area that is protected from rain. As time permits, or when the container is full, take the Ropes to an approved site for disposal. Storage of partially spent Prepac Ropes in a closed container may result in a fire hazard. Large numbers of Prepac Ropes stored in open containers may ignite if contacted by liquids.

Prepac Ropes may also be “dry deactivated” by spreading them out on the ground in a secure, open area away from inhabited buildings to be deactivated by atmospheric moisture. Care should be taken to ensure that the Ropes are not carried away by the wind. If desired, they may be weighted down by several inches of dry sand or soil or by other suitable means.

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

After deactivation, the spent Prepac Ropes may be gathered for disposal at approved sites.

**Caution:** Transport spent Prepac Ropes in open vehicles and allow for air circulation between baskets of Prepacs.

- 12.4.5 Incompletely reacted Prepac Ropes 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.

Submerge the entire Prepac Rope in the deactivating solution to a depth of 10cm or more. The Ropes may float to the surface, therefore, it is necessary to hold them under water by use of a suitable weight. Caution: Partially spent Ropes may ignite if they are allowed to float to the surface of the water. Incompletely spent Prepac Ropes should be mixed into no less than about 40 litres of water/detergent solution for each 21kg of material used. Fill the drum with additional water to eliminate headspace.

The Prepac Ropes should be held under water in this manner for 36 hours or more. Placards should be posted, and the site secured to prevent unauthorized persons from tampering with the drums.

Prepac Ropes may then be taken (with or without preliminary decanting) to an approved site for disposal. The deactivating

solution may be poured onto the ground. Avoid direct pouring into a storm sewer.

## 13. SPILL AND LEAK PROCEDURES

### 13.1 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. For hydrogen phosphide levels between 0.3-15 ppm, the minimum protection required is a NIOSH/MSHA approved air-purifying full-face gas mask with a chin style, front- or back-mounted canister approved for phosphine OR any NIOSH/MSHA approved self-contained breathing apparatus with a full facepiece. For hydrogen phosphide levels up to 50 ppm, any NIOSH/MSHA approved supplied-air respirator with a full facepiece and is operated in a positive pressure mode may be worn. In situations where the hydrogen phosphide concentration is unknown, or to escape from conditions which are Immediately Dangerous to Life or Health (IDLH), a NIOSH/MSHA approved self-contained breathing apparatus (SCBA) with a full facepiece must be worn and operated in a positive pressure mode. 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®. The addition of liquid to the product is prohibited. Liquids in contact with unreacted tablets will greatly accelerate the production of hydrogen phosphide gas which could result in a toxic and/or fire hazard.

Return all intact Prepac Ropes to their original steel pail provided that the pail has not been extensively damaged. Pails which have been extensively damaged or punctured so as to leak may be temporarily repaired with aluminum tape. Caution: These damaged and repaired pails may flash upon opening at some later time. **When possible, open pails outdoors. Do not open pails in an explosive environment (e.g. flour mill).**

Alternatively, the spilled and damaged pails may be placed in packaging which has been suitably constructed and marked according to T.D.G.A. regulations. Transfer the damaged containers for inspection to an area suitable for pesticide storage. Notify consignee and shipper of damage. Further information and recommendations may be obtained, if necessary, for DEGESCH America, Inc.

In some spills, the product or its packaging may be so severely damaged that it cannot be stored for any appreciable length of time. If the product cannot be disposed of by use according to label instructions, it must be "wet deactivated" prior to ultimate disposal as described in Section 13.2.

### 13.2 Deactivation of Phostoxin® by the Wet Method

This is similar to the Sec. 12.4.5 (Wet deactivation method). The differences are that more water is required, and that any water which bubbles out of the drum is replaced.

- 13.2.1 **Caution: Wear appropriate respiratory protection during wet deactivation of unexposed or incompletely exposed Phostoxin®. Never place 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.**
- 13.2.2 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.
- 13.2.3 Submerge the Prepac Ropes completely in the deactivating solution. The Ropes may float to the surface, therefore, it is necessary to hold them under water by use of a suitable weight. Prepac Ropes should be mixed into no less than 57 litres of water/detergent solution for each 21kg of material to be deactivated. This should be done in the open air. Do not cover the container at any time. Top-up the drum to replace any water which spills over the sides. Caution: Partially spent Prepac Ropes may ignite if they are allowed to float to the surface of the water.
- 13.2.4 Keep a water supply on hand to top-up the drum as necessary. Allow the mixture to stand for 36 hours. The Prepac Ropes will have reacted by this time and will then be safe for disposal.
- 13.2.5 The deactivated Prepac Ropes may then be disposed of (with or without preliminary decanting) at a sanitary landfill or other approved site. The deactivating solution may be poured onto the ground. Avoid direct pouring into a storm sewer.

**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](http://www.degeschamerica.com)  
E-Mail: [degesch@degeschamerica.com](mailto: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 DEGESH 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.