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Systems Integration Group, Inc.

**RESTRICTED USE PESTICIDE**  
**DUE TO ACUTE INHALATION TOXICITY OF HIGHLY TOXIC HYDROGEN PHOSPHIDE (PHOSPHINE, PH<sub>3</sub>) GAS**  
 For retail sale to and use only by certified applicators 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. Physical presence means on site or on the premises. Read and follow the label and the DEGESCH America, Inc., Applicator's Manual which contains complete instructions for the safe use of this pesticide.

**APPLICATOR'S MANUAL**

**ACCEPTED**  
 for  
**DEGESCH Phostoxin<sup>®</sup>**  
**JAN 25 1999**  
**Prepac Rope**  
 Under the Federal Insecticide, Fungicide, and Rodenticide Act as amended and registered in the EPA Reg. 40285-13  
 Patent No. 4,853,644  
**FOR USE AGAINST INSECTS WHICH INFEST STORED COMMODITIES**  
 Active Ingredient: Aluminum Phosphide ..... 55%  
 Other Ingredients ..... 45%

**KEEP OUT OF REACH OF CHILDREN**  
**DANGER - POISON - PELIGRO**  
**PRECAUCION AL USUARIO:** Si usted no lee ingles, no use este producto hasta que la etiqueta se le haya sido explicado amplemente.  
**(TO THE USER:** If you cannot read English, do not use this product until the label has been fully explained to you.)  
**STATEMENT OF PRACTICAL TREATMENT**  
 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 or emergency treatment facility.  
 If the gas or dust from aluminum phosphide is inhaled:  
 Get exposed person to fresh air. Keep warm and make sure person can breathe freely. If breathing has stopped, give artificial respiration by mouth-to-mouth or other means of resuscitation. Do not give anything by mouth to an unconscious person.  
 If aluminum phosphide pellets, tablets or powder are swallowed:  
 Drink or administer one or two glasses of water and induce vomiting by touching back of throat with finger, or if available, syrup of ipecac. Do not give anything by mouth if victim is unconscious or not alert.  
 If powder or granules of aluminum phosphide 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.  
 If dust from pellets or tablets gets in eyes:  
 Flush with plenty of water. Get medical attention.

**DEGESCH AMERICA, INC.**

Weyers Cave, Virginia 24488 USA • Telephone (540)234-9281  
 EPA Est. No. 40285-VA-01  
 EPA Reg. No. 40285-13

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

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

**WARRANTY**

Seller warrants that the product conforms to its chemical description and when used according to label directions under normal conditions of use, it is reasonably fit for the purposes stated on the label. Seller makes no other warranty, either express or implied, and buyer assumes all risk should the product be used contrary to label instructions.

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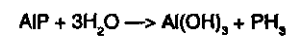
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## 1. INTRODUCTION

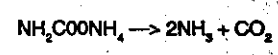
Phostoxin fumigants are used to protect stored commodities from damage by insects and for the control of burrowing pests. Fumigation of stored products with Phostoxin in the manner prescribed in the labeling does not contaminate the marketed commodity.

Phostoxin and other DEGESCH 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 (AlP) as their active ingredient and will liberate hydrogen phosphide via the following chemical reaction:



Hydrogen phosphide gas is highly toxic to insects, burrowing pests, 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 for the DEGESCH Phostoxin Prepac Rope.

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 Tablets-R. The Rope measures roughly 8 inches wide by 21.5 feet long and is composed of 32 interconnected Phostoxin Tablet Prepacs, each Prepac containing 33 round tablets. The Tablet Prepacs are approximately 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, 6.5-gallon metal pails, 2 Ropes per pail. The pails are constructed to conform to D.O.T. Specification 37A; Steel Drums.

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 fleeca into the surrounding space. This reaction starts slowly, gradually accelerates and then tapers off 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 are high, decomposition of Phostoxin may be complete in less than 3 days. However, at lower ambient temperatures and relative humidity levels, decomposition of Phostoxin may require 5 days or more. After decomposition, Phostoxin leaves a gray-white powder composed almost entirely of aluminum hydroxide and other approved inert ingredients. This powder will be retained inside the fleeca 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. This is not considered a hazardous waste. However, partially spent residual from incompletely exposed Phostoxin will 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 Applicators 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 structures.
3. Person supervising must be a certified fumigator and personnel assisting must be trained in the use of Phostoxin. Never allow uninstructed personnel to handle Phostoxin.
4. Approved respiratory protection must be available for fumigation of structures from within.
5. It is not necessary to wear gloves or other protective clothing when handling Phostoxin Prepac Ropes. However,

6. ever, wear dry gloves of cotton or other material if contact with Phostoxin tablets, pellets or dust is likely. 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. Containers may be opened inside the structure to be fumigated provided worker's exposure to hydrogen phosphide gas does not exceed allowable limits.
7. Do not allow Phostoxin to contact liquid water or to pile up.
8. Dispose of empty containers and spent Ropes in a proper manner consistent with the label instructions.
9. Post warning placards on fumigated areas.
10. Prior to fumigation, notify appropriate company employees. Provide to local officials (fire department, rescue squad, police, etc.) on an annual basis relevant safety information for use in the event of an emergency.
11. Hydrogen phosphide fumigants are not to be used for vacuum fumigations.
12. Exposures to hydrogen phosphide must not exceed the eight hour TWA of 0.3 ppm during application, or a ceiling concentration of 0.3 ppm after application is completed.
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 Phostoxin must be aerated for 48 hours prior to offering to the end consumer.
15. Transfer of a treated commodity to another site without complete aeration is permissible provided that the new storage site is placarded if its concentration is above 0.3 ppm.
16. Keep containers of Phostoxin tightly closed except while removing product for application.
17. Protect materials containing metals such as copper, silver, gold and their alloys and salts from corrosive exposure to hydrogen phosphide.
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.

- 19. Do not use aluminum phosphide containers for any purpose other than recycling or reconditioning.
- 20. OSHA recommends preexposure screening of employees to detect impaired pulmonary function. They recommend that any employees developing this condition be referred for medical examination.

**2. PRECAUTIONARY STATEMENTS**

**2.1 Hazards to Humans and Domestic Animals**

**DANGER:** Aluminum phosphide from DEGESCH 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 moisture, water or acids, these products will release hydrogen phosphide (phosphine, PH<sub>3</sub>) which is an extremely toxic gas. If a garlic odor is detected, refer to the Industrial Hygiene Monitoring Section on Page 26 of the Applicator's Manual for appropriate monitoring procedures. Pure hydrogen phosphide gas is odorless; the garlic odor is due to a contaminant. Since the odor of hydrogen phosphide may not be detected under some circumstances, the absence of a garlic odor does not mean that dangerous levels of hydrogen phosphide gas are absent. Observe proper reentry procedures specified elsewhere in the labeling to prevent overexposure.

**2.2 Statement of Practical Treatment**

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 or emergency treatment facility.

**If the gas or dust from aluminum phosphide is inhaled:** Get exposed person to fresh air. Keep warm and make sure person can breathe freely. If breathing has stopped, give artificial respiration by mouth-to-mouth or other means of resuscitation. Do not give anything by mouth to an unconscious person.

**If aluminum phosphide pellets, tablets or powder are swallowed:** Drink or administer one or two glasses of water and induce vomiting by touching back of throat with finger, or if available, syrup of ipecac. Do not give anything by mouth if victim is unconscious or not alert.

**If powder or granules of aluminum phosphide 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.

**If dust from pellets or tablets gets in eyes:** Flush with plenty of water. Get medical attention.

**2.3 Note to Physician (we recommend that this section be given to the attending physician)**

Aluminum phosphide tablets, pellets or dust reacts 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 color), 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 hyperemia (excess of blood in a body part), small perivascular brain hemorrhages and brain edema (fluid in brain). 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 color) and (3) kidney hematuria (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 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 (1.0 mg/kg) (in case of hemoconcentration, 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 hemodialysis 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.

2.4 Physical and Chemical Hazards

Aluminum phosphide in Phostoxin Prepac Ropes and partially spent materials 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 buildup 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 this material may result in formation of an explosive atmosphere. Aluminum phosphide fumigants should not be stacked or piled up or contacted with liquid water. 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, it may react with certain metals and cause corrosion, especially at higher temperatures and relative humidities. Metals such as copper, brass and other copper alloys, and precious metals such as gold and silver are susceptible to corrosion by phosphine. 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.

3. DIRECTIONS FOR USE

3.1 General

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

3.1.1 DEGESCH Phostoxin Prepac Rope is a Restricted Use Pesticide due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH<sub>3</sub>) gas. This product is for retail sale to and use only by certified applicators 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. Physical presence means on site or on the premises. Read and follow the label and the DEGESCH America, Inc., Applicator's Manual which contains complete instructions for the safe use of this pesticide.

3.1.2 Phostoxin 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 Manual are available from:

DEGESCH America, Inc.  
P. O. Box 116  
Weyers Cave, VA 24486  
(540) 234-9281  
or  
Internet address:  
<http://www.degeschamerica.com>

Persons working with **Phostoxin** 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.

- 3.1.3 At least two persons trained in the use of **Phostoxin** must be present during fumigation of structures if entry into the structure is required for application of the fumigant. Two trained persons must also be present during reentry into fumigated or partially aerated structures. Only one trained person is required to be present when **Phostoxin** is applied from outside the area to be treated.
- 3.1.4 Shipholds, barges, containers on ships, railroad cars and containers shipped piggyback by rail may be fumigated in transit. However, trucks, vans, trailers and similar transport vehicles cannot be moved over public roads or highways until they are aerated and the warning placards removed.
- 3.1.5 Do not fumigate commodities with **Phostoxin** when commodity temperature is below 40°F (5°C).
- 3.1.6 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.
- 3.1.7 It is not necessary to wear gloves or other protective clothing when handling **Phostoxin** Prepac Ropes. However, wear dry gloves of cotton or other material while handling **Phostoxin** tablets and pellets. Wash hands thoroughly after use.
- 3.1.8 **Phostoxin** Prepac Ropes must be removed for disposal at the end of the fumigation period.
- 3.1.9 **Phostoxin** Prepac Ropes may be subdivided for treatment of smaller spaces or for application of exact dosages. The Prepac Rope may be cut with a knife, scissors or other sharp instrument. Care should be taken in cutting so that the fleece blisters are not damaged and **Phostoxin** dust allowed to leak from Prepac. It is recommended that only complete Prepacs of tablet blisters each be cut from the Prepac Rope. Remaining portions of the cut Prepac Rope must be used immediately or returned to storage in its steel pail as quickly as possible.

- 3.1.10 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.
- 3.1.11 Hydrogen phosphide gas may flash at concentrations above its flammable limit. Therefore, never open **Phostoxin** 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. These precautions will also reduce the applicator's exposure to hydrogen phosphide gas. Containers may be opened inside the structure to be fumigated provided worker's exposure to hydrogen phosphide gas does not exceed allowable limits.
- 3.1.12 Piling of **Phostoxin** Prepac Ropes or addition of liquid water may speed up the reaction, cause a temperature increase and confine the gas so that ignition could occur.
- 3.1.13 The metal pails in which the Prepac Ropes are packed 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.
- 3.1.14 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 **Phostoxin**.
- 3.1.15 **Phostoxin** or its residual dust must not come in contact with processed foods or commodity packages intended for retailers.
- 3.1.16 Respiratory protection approved for the concentration to which the fumigator will be exposed must be available if **Phostoxin** is to be applied from within the structure to be fumigated. Respiratory protection need not be available for application of Prepac Ropes from outside the structure to be fumigated if exposures above the permissible limits will not be encountered.



A NIOSH/MSHA approved, full-face gas mask - hydrogen phosphide canister combination may be used at levels up to 15 ppm. Above this level or in situations where the hydrogen phosphide concentration is unknown, a NIOSH/MSHA approved, self-contained breathing apparatus (SCBA) or its equivalent must be used.

3.1.17 Notify appropriate company employees prior to fumigation. Provide to local officials (fire department, rescue squad, police, etc.) on an annual basis relevant safety information for use in the event of an emergency.

3.2 Efficacy

Phostoxin has been found effective against the following insects and their preadult stages - that is, eggs, larvae and pupae:

- |                       |                          |
|-----------------------|--------------------------|
| almond moth           | hairy fungus beetle      |
| angoumois grain moth  | Hessian fly              |
| bean weevil           | Indian meal moth         |
| bees                  | Khapra beetle            |
| cadelle               | lesser grain borer       |
| cereal leaf beetle    | maize weevil             |
| cigarette beetle      | Mediterranean flour moth |
| confused flour beetle | pink bollworm            |
| dermestid beetles     | raisin moth              |
| dried fruit beetle    | red flour beetle         |
| dried fruit moth      | rice weevil              |
| European grain moth   | rusty grain beetle       |
| flat grain beetle     | saw-toothed grain beetle |
| fruit flies           | spider beetles           |
| granary weevil        | tobacco moth             |
| greater wax moth      | yellow meal worm         |

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, unfavorable 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 favorable.

3.3 Exposure Conditions

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

Temperature	Phostoxin Prepac Rope Minimum Exposure Periods
below 40°F (5°C)	Do not fumigate
40°-53°F (5-12°C)	10 days (240 hours)
54°-59°F (12-15°C)	5 days (120 hours)
60°-68°F (16-20°C)	4 days (96 hours)
above 68°F (20°C)	3 days (72 hours)

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. Since insects are more tolerant to hydrogen phosphide at low temperatures, the length of exposure should be extended during colder weather. Additionally, aluminum phosphide produces gas more slowly in the cold at low humidity. Therefore, the fumigation period should be long enough for more or less complete reaction of Phostoxin with moisture so that little unreacted material 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.

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 Phostoxin Prepac Ropes" on Page 28.

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.

**3.4 Commodities Which May be Fumigated with Phostoxin**  
Phostoxin may be used for the fumigation of listed raw agricultural commodities, animal feed and feed ingredients, processed foods, tobacco and certain other nonfood items.

**3.4.1 Raw Agricultural Commodities, Animal Feed and Feed Ingredients Which May Be Fumigated with Phostoxin**

- |                           |                       |
|---------------------------|-----------------------|
| almonds                   | pecans                |
| animal feed & ingredients | pistachio nuts        |
| barley                    | popcorn               |
| Brazil nuts               | rice                  |
| cashews                   | rye                   |
| cocoa beans               | safflower seed        |
| coffee beans              | sesame seed           |
| corn                      | seed & pod vegetables |
| cottonseed                | sorghum               |
| dates                     | soybeans              |
| filberts                  | sunflower seeds       |
| flower seed               | triticale             |
| grass seed                | vegetable seed        |
| millet                    | walnuts               |
| oats                      | wheat                 |
| peanuts                   |                       |

**3.4.2 Processed Foods**

The listed processed foods may be fumigated with Phostoxin Prepac Ropes. Under no condition shall any processed food or bagged commodity come in contact with Phostoxin tablets, pellets or residual dust except that Phostoxin may be added directly to processed brewer's rice, malt and corn grits for use in the manufacture of beer.

**Processed Foods Which May Be Fumigated With Phostoxin**

- Processed Candy and Sugar
- Cereal Flours and Bakery Mixes
- Cereal Foods (including cookies, crackers, macaroni, noodles, pasta, pretzels, snack foods and spaghetti)
- Processed Cereals (including milled fractions and packaged cereals)
- Cheese and Cheese Byproducts
- Chocolate and Chocolate Products (assorted chocolate, chocolate liquor, cocoa, cocoa powder, dark chocolate coating and milk chocolate)
- Processed Coffee
- Corn Grits
- Cured, Dried and Processed Meat Products and Dried Fish
- Dates and Figs
- Dried Eggs and Egg Yolk Solids
- Dried Milk, Dried Powdered Milk, Nondairy Creamers, and Nonfat Dried Milk
- Dried or Dehydrated Fruits (apples, dates, figs, peaches, pears, prunes, raisins and sultanas)
- Processed Herbs, Spices, Seasonings and Condiments
- Malt
- Processed Nuts (almonds, apricot kernels, Brazil nuts, cashews, filberts, peanuts, pecans, pistachio nuts and walnuts)
- Processed Oats (including oatmeal)
- Rice (brewer's rice grits, enriched and polished, wild rice)
- Soybean Flour and Milled Fractions
- Processed Tea
- Dried and Dehydrated Vegetables (beans, carrots, lentils, peas, potato flour, potato products and spinach)
- Yeast (including primary yeast)

**4.3 Nonfood Commodities, Including Tobacco**

The listed nonfood items may be fumigated with Phostoxin. Tobacco, psyllium seed and psyllium seed husks intended for

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**3.4.2 Processed Foods**

The listed processed foods may be fumigated with Phostoxin Prepac Ropes. Under no condition shall any processed food or bagged commodity come in contact with Phostoxin tablets, pellets or residual dust except that Phostoxin may be added directly to processed brewer's rice, malt and corn grits for use in the manufacture of beer.

**Processed Foods Which May Be Fumigated With Phostoxin**

Processed Candy and Sugar  
 Cereal Flours and Bakery Mixes  
 Cereal Foods (including cookies, crackers, macaroni, noodles, pasta, pretzels, snack foods and spaghetti)  
 Processed Cereals (including milled fractions and packaged cereals)  
 Cheese and Cheese Byproducts  
 Chocolate and Chocolate Products (such as assorted chocolate, chocolate liquor, cocoa, cocoa powder, dark chocolate coating and milk chocolate)  
 Processed Coffee  
 Corn Grits  
 Cured, Dried and Processed Meat Products and Dried Fish  
 Dates and Figs  
 Dried Eggs and Egg Yolk Solids  
 Dried Milk, Dried Powdered Milk, Nondairy Creamers, and Nonfat Dried Milk  
 Dried or Dehydrated Fruits (such as apples, dates, figs, peaches, pears, prunes, raisins, citrus and sultanas)  
 Processed Herbs, Spices, Seasonings and Condiments  
 Malt  
 Processed Nuts (such as almonds, apricot kernels, Brazil nuts, cashews, filberts, macadamia nuts, peanuts, pecans, pistachio nuts and walnuts)  
 Processed Oats (including oatmeal)  
 Rice (brewer's rice grits, enriched and polished, wild rice)  
 Soybean Flour and Milled Fractions  
 Processed Tea  
 Dried and Dehydrated Vegetables (such as beans, carrots, lentils, peas, potato flour, potato products and spinach)  
 Yeast (including primary yeast)  
 Other processed foods

**3.4.3 Nonfood Commodities, Including Tobacco**

The listed nonfood items may be fumigated with Phostoxin. Tobacco, psyllium seed and psyllium seed husks intended for drug use and certain other of the nonfood commodities should not be contacted by tablets, pellets 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.

**Nonfood Commodities Which May be Fumigated With Phostoxin**

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

drug use and certain other of the nonfood commodities should not be contacted by tablets, pellets 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.

**Nonfood Commodities Which May be Fumigated With Phostoxin**

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

3.5

**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 10,000 bushel bin whether it is empty or full of commodity 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 7300 to 52,800 cubic feet. Note: The maximum dosage for dates, nuts and dried fruits is one Prepac Rope per 26,400 cubic feet. This dosage is not to be exceeded. It is important to be aware that a shortened exposure period cannot be fully compensated for with an increased dosage of hydrogen phosphide.

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The wide dosage range 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. A good illustration of this point is comparison of the low dosages required to treat modern, well-sealed warehouses with the higher range used for poorly constructed buildings that cannot be sealed adequately. 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.

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

**Recommended Phostoxin Prepac Rope Dosages for Various Types of Fumigations**

	Volume Range (Cubic Feet)	
	Per Tablet Prepac	Per Prepac Rope
1. Space		
mills, warehouses, etc.	550 - 1650	17,600 - 52,800
bagged commodities	550 - 1100	17,600 - 35,200
processed dried fruits and nuts	825 - 1650	26,400 - 52,800
stored tobacco	825 - 1650	26,400 - 52,800
2. Bulk Stored Commodities		
vertical storages	550 - 1100	17,600 - 35,200
tanks	470 - 1100	15,040 - 35,200
flat storages	230 - 660	7,360 - 21,120
(loose construction)		
farm bins	230 - 470	7,360 - 15,040
bunkers & tarped	410 - 1100	13,120 - 35,200
ground storages		
railcars	510 - 1100	16,320 - 35,200
barges	230 - 660	7,360 - 21,120
shipholds	500 - 1100	16,000 - 35,200

Higher dosages are recommended in 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.

3.6

**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, unmanned barges 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.**

The following instructions are intended to provide general guidelines for typical fumigations. These instructions are not intended to cover every type of situation nor are they meant to be restrictive. Other procedures may be used if they are safe, effective and consistent with the properties of aluminum phosphide products.

3.6.1

**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 liquid water.

Tarping of the surface of the commodity is often advisable particularly if the overhead of the storage cannot be sealed.

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

3.6.2

**Fumigation Procedures for 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 the 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 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. Make sure that all of the material applied has been accounted for.
7. Remove fumigation warning placards from the aerated structure.

3.6.3

**Tarpaulin and Bunker Fumigations**

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. Poly tarps are penetrated only very slowly by hydrogen phosphide gas, and tight coverings are readily formed from the sheets. 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, or plastic bunker storage capable of holding 600,000 bushels 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 flooring upon which the commodity rests is 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. Thinner poly, about 2 mil, is suitable for most indoor tarp fumigations and for sealing of windows, doors and other openings in structures. However, 4 mil poly or thicker is more suitable for outdoor applications where wind or other mechanical stresses are likely to be encountered.

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 sources of moisture are likely to form beneath the poly. 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.

Place warning placards at conspicuous points on the enclosure.

Excellent results may be attained in the treatment of smaller 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 230 to 1650 cubic feet. Phostoxin Prepac Ropes may be subdivided for treatment of smaller spaces. Ropes may be cut with a knife, scissors or other sharp instrument. Care should be taken in cutting so that the fleece blisters are not damaged and Phostoxin dust allowed to leak from the Prepac. It is recommended that only complete Prepacs of 33 tablet blisters each be cut from the Prepac Rope. Remaining portions of the cut Rope must be used immediately or returned to storage in its steel pail as quickly as possible.

3.6.4 Fumigation of Ships

3.6.4.1 General Information

1. Important - shipboard, intransit ship or shiphold fumigation is also governed by U.S. Coast Guard Regulation 46 CFR 147A. Refer to this regulation prior to fumigation.
2. DEGESCH Phostoxin Prepac Ropes are classified by EPA as restricted use pesticides due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH<sub>3</sub>) gas. This product is for retail sale to and use only by certified applicators 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. Physical presence means on site or on the premises. Read and follow the label and the DEGESCH America, Inc., Applicator's Manual which contains complete instructions for the safe use of this pesticide.

3.6.4.2 Pre-Voyage Fumigation Procedures

1. Prior to fumigating a vessel for intransit cargo fumigation, the master of the vessel, or his 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 will not be fumigated unless all crew members are removed from the vessel. The crew members will not be allowed to reoccupy the vessel until the vessel has been properly aerated 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 representative, of the requirements relating to personal protection equipment\*, detection equipment and 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 representative.

\*Personal protection equipment means a NIOSH/MSHA approved respirator or gas mask fitted with an approved canister for phosphine. The canister is approved for use up to 15 ppm. SCBA or its equivalent must be used above 15 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.
- 5. If the fumigation is not completed and the vessel aerated before the manned vessel leaves port, the person in charge of the vessel shall ensure that at least two units of personal protection equipment and one gas or vapor detection device, and a person qualified in their operation be on board the vessel during the voyage.

- 6. During the fumigation or until a manned vessel leaves port or the cargo is aerated, the person in charge of the fumigation shall ensure that a qualified person using gas or vapor detection equipment tests spaces adjacent to spaces containing fumigated cargo and all regularly occupied spaces for fumigant leakage. 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 representative, of the leakage so that corrective action can be taken.

- 7. Review with the master, or his representative, the precautions and procedures for during the voyage.

3.6.4.3 Application Procedures for Bulk Dry Cargo Vessels 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.

3.6.4.4 Precautions and Procedures During Voyage

- 1. Using appropriate gas detection equipment, 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 occupied.
- 2. Do not enter fumigated areas except under emergency conditions. If necessary to enter a fumigated area, appropriate personal protection equipment must be used. Never enter fumigated areas alone. At least one other person, wearing personal protection equipment, should be available to assist in case of an emergency.

**3.6.4.5 Precautions and Procedures During Discharge**

1. If necessary to enter a treated area prior to discharge, test spaces directly above commodity 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 safe levels, as indicated by a suitable detector.

**3.6.5 Fumigation of Barges**

Barge fumigations are also regulated by U. S. Coast Guard Regulation 46 CFR 147A as modified by U. S. Coast Guard Special Permit 2-75. This permit which must be obtained prior to the fumigation is available from:

Commandant  
 U. S. Coast Guard  
 Hazardous Materials Standards Div.  
 GMSO-3  
 Washington, DC 20593-0001

**4. 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 material if contact with Phostoxin tablets, pellets or dust is likely. Wash hands thoroughly after handling aluminum phosphide products. Aerate used gloves and other contaminated clothing in a well ventilated area prior to laundering.

**5. RESPIRATORY PROTECTION**

**5.1 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. Respiratory protection is required if exposure is likely to exceed the eight hour TWA of 0.3 ppm during application, or a 0.3 ppm ceiling at any time afterwards. For example, respiratory protection is required to be worn upon reentry into a partially aerated structure if the hydrogen phosphide concentration is above 0.3 ppm. 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. Infor-

mation on hydrogen phosphide (phosphine, PH<sub>3</sub>) detector tubes may be obtained from DEGESCH America, Inc., or your DEGESCH distributor.

**5.2 Permissible Gas Concentration Ranges for Respiratory Protection Devices**

A NIOSH/MSHA approved, full-face gas mask - hydrogen phosphide canister combination may be used at levels up to 15 ppm or to escape from levels up to 1500 ppm. Above this level or in situations where the hydrogen phosphide concentration is unknown, a NIOSH/MSHA approved, self-contained breathing apparatus (SCBA) or its equivalent must be used. The NIOSH/OSHA Pocket Guide, 8-85, DHEW/NIOSH 78-210, lists these and other types of approved respirators and the concentration limits at which they may be used.

**5.3 Requirements for Availability of Respiratory Protection**

If Phostoxin is to be applied from within the structure to be fumigated, an approved full-face gas mask - phosphine canister combination or self-contained breathing apparatus (SCBA) or its equivalent must be available at the site of application in case it is needed. In addition, SCBA or its equivalent must be available locally, for example, at fire station or rescue squad if it is not available at the fumigation site.

Respiratory protection need not be available for applications from outside the area to be fumigated such as addition of tablets or pellets to automatic dispensing devices, outdoor applications, etc., if exposures above the permitted exposure limits will not be encountered.

If monitoring equipment is not available on a farm and application of fumigant cannot be made from outside the structure, an approved canister respirator must be worn during application from within the structure being treated.

**6. PLACARDING OF FUMIGATED AREAS**

The applicator must placard or post all entrances to the structures under fumigation with signs bearing, in English and Spanish:

1. The signal word DANGER/PELIGRO and the SKULL AND CROSSBONES symbol in red.
2. The statement "Area and/or commodity under fumigation, DO NOT ENTER/NO ENTRE".
3. The statement, "This sign may only be removed after the commodity is completely aerated (contains 0.3 ppm or less of



hydrogen phosphide gas). If incompletely aerated commodity is transferred to a new site, the new site must also be placarded if it contains more than 0.3 ppm. Workers must not be exposed to more than 0.3 ppm hydrogen phosphide."

- 4. The date and time fumigation begins and is completed.
- 5. Name of fumigant used.
- 6. Name, address and telephone number of the applicator.

All entrances to a fumigated area 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. Transfer of incompletely aerated commodity to a new site is permissible. However, the new storage must be placarded if it contains more than 0.3 ppm hydrogen phosphide. No placarding is required if aeration occurs during transfer. Workers who handle incompletely aerated commodity must be informed and appropriate measures taken (i.e., ventilation or respiratory protection) to prevent exposures from exceeding 0.3 ppm hydrogen phosphide.

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.

## 7. AERATION OF FUMIGATED COMMODITIES

### 7.1 Foods and Feeds

Tolerances for hydrogen phosphide residues have been established at 0.1 ppm for animal feeds and 0.01 ppm for finished food. To guarantee compliance with these tolerances, it is necessary to aerate these commodities for 48 hours prior to offering them to the end consumer. As an alternative to this aeration period, each

container of the treated commodity may be analyzed for residues using accepted analytical methods.

### 7.2 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.

## 8. APPLICATOR AND WORKER EXPOSURE

### 8.1 Hydrogen Phosphide Exposure Limits

Exposure to hydrogen phosphide gas may not exceed 0.3 ppm, measured as an eight hour time-weighted average (TWA), 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.

After application, exposure for any person may not exceed a 0.3 ppm ceiling for hydrogen phosphide. Such exposures may occur if the commodity or space under fumigation leaks, when treated commodity is transferred or handled, if an unaerated or partially aerated space is entered, etc.

### 8.2

#### Application of Fumigant

Depending upon temperature and humidity, DEGESCH Phostoxin Prepac Ropes release hydrogen phosphide gas slowly upon exposure to moisture from the air. In most cases, this release is slow enough to permit applicators to deposit fumigant in the desired areas and then vacate the premises without significant exposure to the gas. If the fumigator's exposure exceeds the eight hour TWA of 0.3 ppm, approved respiratory protection must be worn. When required, gas concentration measurements for safety purposes may be made using low level detector tubes. See the writeup below on Industrial Hygiene Monitoring. Information on hydrogen phosphide (phosphine, PH<sub>3</sub>) detector tubes may be obtained from DEGESCH America, Inc., or your DEGESCH distributor.

It is often advisable to wear respiratory protection during application of fumigant under hot and humid conditions, par-

ticularly when considerable time must be spent inside the structure being treated.

**8.3 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 like 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.

**8.4 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.

**8.5 Handling Un-aerated Commodities**

Workers must not be exposed to hydrogen phosphide in excess of 0.3 ppm during moving, storage or processing of incompletely aerated commodities.

**8.6 Industrial Hygiene Monitoring**

It is recommended that hydrogen phosphide exposures be documented in an operations log or manual for each site at operation where exposures may occur. The purpose of this monitoring is to prevent excessive exposures and to determine when and where respiratory protection is required. 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 odor 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.

**9. 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. **DEGESCH Phostoxin** Prepac Ropes are supplied in 6.5 gallon gas-tight, resealable metal pails. Once opened for fumigation, any unused material should be sealed again as quickly as possible in order to minimize unwanted liberation of gas.
4. The shelf life of **Phostoxin** is virtually unlimited as long as the containers are tightly sealed.

**J. DISPOSAL INSTRUCTIONS**

**10.1 General**

- 10.1.1 Do not contaminate water, food or feed by storage or disposal.
- 10.1.2 Unreacted or partially reacted **Phostoxin** is acutely hazardous. Improper disposal of excess pesticide is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance. For specific instructions, see Section 11 of this manual, Spill and Leak Procedures.
- 10.1.3 Some local and state waste disposal regulations may vary from the following recommendations. Disposal procedures

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should be reviewed with appropriate authorities to ensure compliance with local regulations. Contact your state Pesticide or Environmental Control Agency or Hazardous Waste Specialist at the nearest EPA Regional Office for guidance.

10.1.4 Dispose of containers in a sanitary landfill or by other procedures approved by state and local authorities.

10.1.5 If properly exposed, the residual dust remaining after a fumigation with Phostoxin will be a grayish-white and contain only a small amount of unreacted aluminum phosphide. However, residual dust from incompletely exposed Phostoxin, so called "green dust," will require special care.

10.2 Directions for Disposal of Phostoxin Prepac Ropes

10.2.1 Confinement of partially spent Prepac 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. **Caution:** Do not collect partially spent Prepacs in large drums, plastic bags, dumpsters or other containers where confinement may occur.

10.2.2 Ignition may occur if large numbers of incompletely reacted Prepac Ropes are contacted by liquid water. 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.

10.2.3 Small numbers of Ropes, up to about 3 or 4, may be disposed of on site by burial in an open area.

10.2.4 Spent Phostoxin Prepac Ropes may be collected and disposed of at a sanitary landfill, incinerator, or other approved sites or by other procedures approved by Federal, State or Local authorities. Ropes containing "green dust" must be further deactivated before disposal at a landfill. Do not confine partially spent Ropes during transport to disposal sites.

10.3 Directions for Deactivation of Phostoxin Prepac Ropes  
In some cases it may be desirable to deactivate Phostoxin Prepac Ropes further prior to ultimate disposal. This is

especially true in cases of incomplete exposure which has resulted in so-called "green dust" or following a fumigation which has produced large quantities of partially spent Ropes.

10.3.1 Phostoxin Prepac Ropes may be "dry deactivated" by storing them 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 Prepac Ropes to an approved site for disposal. Storage of partially spent Ropes in a closed container may result in a fire hazard. Large numbers of Prepacs stored in open containers may ignite if contacted by liquid water.

10.3.2 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 sand or soil or by other suitable means. After deactivation, the spent Ropes may be gathered for disposal at approved sites.

10.3.3 Phostoxin Prepac Ropes may be deactivated as follows using the "Wet Method."

10.3.3.1 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 of detergent is suggested. The container should be filled with deactivating solution to within a few inches of the top.

10.3.3.2 In a well-ventilated area, out of doors, submerge the entire Rope 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. **Caution:** Partially spent Ropes may ignite if they are allowed to float to the surface of the water.

10.3.3.3 The Prepac Ropes should be held under water in this manner for 36 hours. They may then be taken to an approved site for disposal. Dispose of the detergent solution at a sanitary landfill or other approved site or means. *Where permissible,*

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deactivating solution may be poured out onto the ground or it may be poured into a storm sewer.

- 10.3.3.4 **Caution:** Wear appropriate respiratory protection during wet deactivation of partially spent materials. Do not cover the container being used for wet deactivation. Do not dispose of Phostoxin dust in a toilet.

## 11. SPILL AND LEAK PROCEDURES

### 11.1 General Precautions and Directions

A spill, other than incidental to application or normal handling, may produce high levels of gas and, therefore, attending personnel must wear SCBA or its equivalent when the concentration of hydrogen phosphide gas is unknown. Other NIOSH/MSHA approved respiratory protection may be worn if the concentration is known. Do not use water at any time to clean up a spill of Phostoxin. Water in contact with unreacted tablets or pellets will greatly accelerate the production of hydrogen phosphide gas which could result in a toxic and/or fire hazard. Wear dry gloves of cotton or other material when handling aluminum phosphide.

Return all intact Prepac Ropes to their original steel pail provided that the pail has not been extensively damaged. Pails which have been punctured or damaged so as to leak may be temporarily repaired with aluminum tape. **Caution:** These damaged and repaired pails may flash upon opening some later time. 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, from 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 further deactivated prior to ultimate disposal. Small amounts of spillage may be spread 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 sand or soil or by other suitable means. After deactivation, the spent Prepac Ropes may be

gathered for disposal at approved sites. Alternatively, wet deactivation may be carried out as described in the following.

### 11.2 Directions for Deactivation of Prepac Ropes by the Wet Method

If the contaminated material is not to be held until completely reacted by exposure to atmospheric moisture, deactivate the product by the "Wet Method" as follows:

11.2.1 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 or 4 cups in 30 gallons is suggested. The container should be filled with deactivating solution to within a few inches of the top.

11.2.2 The Prepac Ropes are added slowly to the deactivating solution and stirred so as to thoroughly wet all of the Phostoxin. This should be done in the open air. Do not cover the container at any time. Prepac 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.

11.2.3 Allow the mixture to stand for about 36 hours. The Ropes will have reacted by this time and will then be safe for disposal.

11.2.4 The deactivated Prepac Ropes may then be disposed of at a sanitary landfill or other approved site. Dispose of the detergent solution at an approved site or by other approved procedures. Where permissible, the deactivation solution may be poured out onto the ground or it may be poured into a storm sewer.

11.2.5 **Caution:** Wear appropriate respiratory protection during wet deactivation of unexposed or incompletely exposed Phostoxin. Never place Phostoxin 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.

The EPA has determined that proper disposal of aluminum phosphide will cause no unreasonable adverse effects to the environment.

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**FOR ASSISTANCE, CONTACT:**

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