

APPLICATOR'S MANUAL

FOR

DEGESCH FUMI-CEL® AND FUMI-STRIP®



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

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

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

**A FUMIGATION MANAGEMENT PLAN MUST BE WRITTEN FOR
ALL FUMIGATIONS PRIOR TO ACTUAL TREATMENT**

IN FACILITIES THAT USE THIS PRODUCT, ALL EMPLOYEES MUST COMPLETE MANDATORY ANNUAL TRAINING ON THE HAZARDS OF THIS PRODUCT, THE USE OF SAFETY EQUIPMENT (I.E., RESPIRATORY PROTECTION AND PERSONAL MONITORS), AND THE EXPOSURE LIMIT OF 0.1 PPM. IT IS THE RESPONSIBILITY OF THE CERTIFIED/LICENSED APPLICATOR TO INFORM THE PERSON IN CHARGE OF THE FACILITY OR AGRICULTURAL ESTABLISHMENT, WHERE THE FUMIGATION WILL TAKE PLACE, OF THE REQUIREMENT FOR THE MANDATORY TRAINING.

**RESTRICTED
INSECTICIDE AND RODENTICIDE**

DANGER



POISON

**KEEP OUT OF REACH OF CHILDREN AND PREVENT ACCESS BY
UNAUTHORIZED PERSONNEL**

ACTIVE INGREDIENT: Magnesium Phosphide 56%

REGISTRATION NO. 26188 PEST CONTROL PRODUCTS ACT

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THIS PRODUCT IS ACCOMPANIED BY AN APPROVED LABEL, WHICH INCLUDES, THE APPLICATOR'S MANUAL AND GUIDANCE FOR PREPARATION OF A FUMIGATION MANAGEMENT PLAN. READ AND UNDERSTAND THE ENTIRE LABEL AND THE APPLICATOR'S 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 LABEL AND THE APPLICATOR'S MANUAL.

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

MAGNESIUM PHOSPHIDE GRANULES ARE NONCOMBUSTIBLE, BUT EXPOSURE TO MOISTURE IN THE AIR OR WATER RELEASES FLAMMABLE AND TOXIC HYDROGEN PHOSPHIDE (PHOSPHINE, PH_3) 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.

NATURE OF RESTRICTIONS:

The use of this product is RESTRICTED due to the high acute inhalation toxicity of hydrogen phosphide (phosphine, PH₃) gas, which is formed when this product is exposed to moisture in the air.

This product is for retail sale to and use only by individuals holding an appropriate pesticide applicator certificate or license recognized by the provincial/territorial pesticide regulatory agency where the pesticide application occurs or by persons trained in accordance with the Applicator's Manual working under the direct supervision and in the physical presence of an applicator holding an appropriate pesticide applicator certificate or license recognized by the provincial/territorial pesticide regulatory agency where the pesticide application occurs. Consult local pesticide regulatory authorities about use permits which may be required.

This product is accompanied by an approved label, an Applicator's Manual and Guidance for Preparation of a Fumigation Management Plan. READ AND UNDERSTAND THE ENTIRE LABEL AND APPLICATOR'S MANUAL. All parts of the label and manual are equally important for the safe and effective use of this product. Call the manufacturer if you have any questions or do not understand any part of this label and the Applicator's Manual.

In facilities where this product is used, all employees MUST complete mandatory annual training as outlined in the Applicator's Manual – MANDATORY ANNUAL TRAINING. Training includes information on the hazards of this product, the use of safety equipment (i.e., respiratory protection and personal monitors), and the exposure limit of 0.1 ppm. It is the responsibility of the certified/licensed applicator to inform person in charge of the facility or agricultural establishment, where the fumigation will take place, of the requirement for the mandatory training.

A fumigation zone must be established for all fumigated sites (with the exception of ships and railcars that are in motion), refer to the Applicator's Manual – FUMIGATION ZONE REQUIREMENTS. Note that the term "fumigated site/application site" refers to the site under fumigation treatment. Placarding is required for both the fumigated site and the fumigation zone perimeter.

Appropriate respiratory protection MUST be worn at all times when levels of hydrogen phosphide gas are above 0.1 ppm, as outlined in the Applicator's Manual – RESPIRATORY PROTECTION. If the hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm, must be worn. If at any time hydrogen phosphide levels exceed 0.1 ppm, all individuals who are not wearing respiratory protection as outlined in Section 6 MUST vacate the area until hydrogen phosphide levels are at or below 0.1 ppm.

Entry by unprotected workers into the fumigated site is only permitted after the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. Only if necessary, should workers be present in the fumigation zone. All workers present in the fumigation zone during the fumigation or aeration periods MUST wear appropriate respiratory protection, as outlined in the Applicator's Manual – RESPIRATORY PROTECTION, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm. Each unprotected worker in the fumigation zone must have a personal hydrogen phosphide monitor that is functional for the duration of the work period, must know how to operate the personal hydrogen phosphide monitor and be informed of procedures required if the air levels of hydrogen phosphide gas exceed 0.1 ppm.

Note that transport of non-aerated commodities is permitted by rail or ship only. Other transport vehicles, such as trucks, vans, and trailers, are prohibited from travel over public roads or highways until completely aerated to a hydrogen phosphide level at or below 0.1 ppm.

This product must be stored away from lodging for humans, animal quarters and normal work areas to avoid inadvertent exposure. Refer to the Applicator's Manual for detailed storage instructions.

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. Fumi-Cel® may also be used to fumigate bagged, packaged or treated cereal, grass, sorghum or small legume seeds destined for planting use only.

Non-food items may also be fumigated with Fumi-Cel® and Fumi-Strip®: dried plants and flowers; feathers, human hair, rubberized hair, vulcanized hair, mohair leather products, animal hides and fur; paper and paper products, processed or unprocessed cotton wool and other natural fibers or cloth, clothing; seeds (grass seed, ornamental herbaceous plant seed and vegetable seed); straw and hay; tobacco; wood and wood products; tires (for mosquito control); psyllium seed/psyllium seed husks intended for drug use.

Even distribution throughout the commodity is essential for good results. Refer to the Applicator's Manual for detailed Precautions, Safety Recommendations and Directions for Use.

The time of required fumigant exposure is as follows:

Below 5°C	Do not fumigate
at 5-12°C	4 days are required
at 13-15°C	3 days are required
at 16-20°C	2 days are required

A 48-hour post-fumigation aeration period for the raw agricultural commodity (RAC) is required to ensure that phosphine residues fall within the maximum residue limit (MRL). For tobacco, aeration in hogsheads should be not less than three days; on any other type of storage, two days. It is the user's responsibility to ensure that there is no residue on such commodities in excess of these amounts. The licensed/certified applicator is only required to be present until the air concentrations of hydrogen phosphide gas are at or below the exposure limit of 0.1 ppm as outlined in FUMIGATION ZONE REQUIREMENTS.

This product is highly toxic to birds and mammals. Carefully inspect the outside and inside of the structure prior to application of the fumigant to ensure the absence of nesting or roosting birds. Avoid application if birds are present.

This product is not to be used for vacuum fumigations.

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

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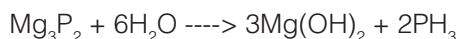
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1. INTRODUCTION

Magnesium phosphide fumigants are used to protect stored commodities from damage by pests. Fumigation of stored products with Fumi-Cel plates or Fumi-Strip® in the manner prescribed in the labeling does not contaminate the marketed commodity.

Magnesium phosphide and other metal phosphide fumigants are acted upon by atmospheric moisture to produce hydrogen phosphide (phosphine, PH₃) gas. The Fumi-Cel® plates and Fumi-Strip® contain magnesium phosphide Mg₃P₂ 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.

The Fumi-Cel® Plates and Fumi-Strip® will liberate only hydrogen phosphide gas. The Plates and Strips do not liberate ammonia and carbon dioxide since they contain no ammonium carbamate as do MAGTOXIN® and PHOSTOXIN® products.

The Fumi-Cel® plates and Fumi-Strip® have a polyethylene matrix which is impregnated with magnesium phosphide along with some inert ingredients. The plate measures about 17 cm by 28 cm and is 4 mm in. thickness (6-3/4 by 11 inches and is 5/32 inches in thickness). The Fumi-Strip is formed by attaching together, end to end, 20 of the Fumi-Cel plates. The Strip measures 5.6 metres (18 feet 4 inches) in length and will liberate 660g (20 x 33g) of hydrogen phosphide gas. Strips and plates are packaged individually in gas-tight aluminum foil pouches. These pouches are not re-sealable. The pouches are in turn packed in a removable head drum, 120 plates of 6 strips, with a net weight of 14.04 kg and will evolve a total of 3960g of hydrogen phosphide gas.

Upon exposure to air, Fumi-Cel plates and Fumi-Strip begin to react with atmospheric moisture to produce small quantities of hydrogen phosphide gas. This reaction starts slowly, gradually accelerates and then tapers off again as the magnesium phosphide is spent. Strips and plates react at about the same rate. Their rate of decomposition will vary depending upon moisture and temperature conditions. For example, when moisture and temperature of the fumigated commodity are high, decomposition of magnesium phosphide products may be complete in less than 2 days. However, at lower ambient temperatures and humidity levels, decomposition may require 4 days or more. Fumi-Cel plates, and Fumi-Strip are much more reactive than PHOSTOXIN which contains aluminum phosphide as its active ingredient. Therefore, these products are better suited for fumigations conducted under cooler and drier conditions.

The Fumi-Cel plates and Fumi-Strip remain intact after fumigation and retain all the spent material. Plates and Strips must be retrieved for disposal at the end of the fumigation period. If properly exposed, the plates and strips will contain virtually no unreacted magnesium phosphide and may be disposed of without hazard. While not considered a hazardous waste, partially spent Plates and Strips will require special care. Precautions and instructions for further deactivation and disposal will be given later in this Applicator's Manual.

DEGESCH Fumi-Cel® plates and Fumi-Strip are supplied in gas-tight containers and their shelf life is unlimited as long as the packaging remains intact. Once pouches are opened for fumigation, the Plates and Strips must be used following label instructions or deactivated for disposal. Storage and handling instructions will be given in detail later in the Applicators Manual.

SAFETY RECOMMENDATIONS SUMMARY

1. Carefully read the label and Applicator's Manual and follow instructions explicitly.
2. Licensed/certified applicator must develop and follow a Fumigation Management Plan and notify appropriate company employees prior to fumigation. Provide to local officials (fire department, rescue squad, police, etc.) relevant safety information for use in the event of an emergency.
3. Never fumigate alone from inside the storage structure. At least two persons, a licensed/certified applicator and trained person, or two persons trained in accordance with the Applicator's Manual working under the direct supervision of the licensed/certified applicator, must be present during fumigation of structures when entry into the structure for application of the fumigant is required. Appropriate respiratory protection, as outlined in Section 6, RESPIRATORY PROTECTION, MUST be worn at all times when levels of hydrogen phosphide gas are above 0.1 ppm. If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm, must be worn. If at any time hydrogen phosphide levels exceed 0.1 ppm, all individuals who are not wearing respiratory protection as outlined in Section 6 MUST vacate the area until hydrogen phosphide levels are at or below 0.1 ppm.
4. Observe all Provincial pesticide legislation requirements.
5. The licensed/certified applicator must maintain visual and/or voice contact with all fumigation workers during the application of the fumigants.
6. Wear a loose fitting long sleeve shirt, long pants, socks and shoes, and wear dry gloves of cotton or other breathable material if contact with Fumi-Cel Plates, Fumi-Strip or dust is likely. Aerate used gloves and other contaminated clothing in a well-ventilated area prior to laundering. Wash hands thoroughly after using magnesium phosphide products.
7. A fumigation zone must be established for all fumigated sites (with the exception of ships and railcars that are in motion) as per the instructions outlined under Section 7, FUMIGATION ZONE REQUIREMENTS. Note that transport of non-aerated commodities is permitted by rail or ship only. Other transport vehicles, such as trucks, vans, and trailers are prohibited from travel over public roads or highways until completely aerated to a hydrogen phosphide level at or below 0.1 ppm.
8. Post warning placards around both the fumigated site and the fumigation zone perimeter as per instructions in Section 10, PLACARDING OF FUMIGATION AREAS.
9. Entry by unprotected workers into the fumigated site is only permitted after the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. Only if necessary, should workers be present in the fumigation zone. All workers present in the fumigation zone during the fumigation or aeration periods MUST wear appropriate respiratory protection, as outlined in the Applicator's Manual – RESPIRATORY PROTECTION, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm. Each unprotected worker in the fumigation zone must have a personal hydrogen phosphide monitor that is functional for the duration of the work period, must know how to operate the personal hydrogen phosphide monitor and be informed of procedures required if the air levels of hydrogen phosphide gas exceed 0.1 ppm.
10. Exposure to hydrogen phosphide must never exceed 0.1 ppm. If workers must handle incompletely aerated commodity, or are indoors (e.g. an enclosed elevator head) they must wear appropriate respiratory protection (see Section 6, RESPIRATORY PROTECTION).
11. Keep containers of Fumi-Cel and Fumi-Strip® tightly closed except while removing product for application. 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.
12. Piling of Fumi-Cel Plates, Fumi-Strip or the addition of liquid to the product is prohibited.
13. Dispose of empty containers and spent residual dust in a manner consistent with the label instructions.
14. Hydrogen phosphide fumigants are not to be used for vacuum fumigations.
15. Finished foods and feeds which have been fumigated with magnesium phosphide must be aerated for 48 hours prior to offering to the end consumer.
16. Hydrogen phosphide will corrode copper and precious metals at high concentrations or humidity levels. Protection or removal of wiring, sensitive equipment or precious metals is recommended under these conditions.
17. **FUMI-CEL®** plates and **FUMI-STRIP®** may be used for the fumigation of packaged goods, processed foods and other commodities where direct contact with metal phosphide fumigant or its reacted residue is illegal or not desired. Under no circumstances shall any processed food, feed or bagged commodity come into direct contact with Fumi-Cel® Plates, Fumi-Strip or residual dust, or a raw agricultural commodity that will be used directly as a food without further processing
18. Do not use magnesium phosphide containers for any purpose other than recycling or reconditioning.
19. Pre-exposure screening of employees to detect impaired pulmonary function is recommended. Any employees developing this condition should be referred for medical examination.
20. Theft of products: Immediately report to the local police department thefts of metal phosphide fumigants.
21. Registrant must be informed of any incident involving the use of this product.

2. **FIRST AID**

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

FIRST AID RESPONDER PROTECTION: Hydrogen phosphide gas is a highly toxic systemic poison and a severe respiratory tract irritant. Persons exposed to solid phosphides, which react with moisture to produce hydrogen phosphide gas, can pose risks to others if phosphides are on clothes, skin, or hair. First Aid responders should protect themselves through the use of appropriate personal protective equipment before attempting to rescue or care for a person who has been exposed to a hydrogen phosphide gas-releasing product, and/or if entering a zone with potentially unsafe hydrogen phosphide levels. A NIOSH-approved self-contained breathing apparatus (SCBA) with a full face piece operated in a pressure-demand or other positive-pressure mode OR a NIOSH-approved air-line respirator with a full face piece operated in a pressure-demand or other positive-pressure mode combined with an auxiliary self-contained positive-pressure breathing apparatus is recommended in response situations that involve exposure to potentially unsafe or unknown levels of hydrogen phosphide (see Section 4, PRECAUTIONS, of product label or Applicator's Manual for further guidance regarding personal protective equipment.)

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

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

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

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

HOT LINE NUMBER

Have the product container label or Applicator's Manual with you when calling a poison control centre, doctor, or when going for treatment. **CONTACT 1-800-308-4856 FOR ASSISTANCE WITH HUMAN OR ANIMAL MEDICAL EMERGENCIES.** You may also contact DEGESCH AMERICA, INC. 540-234-9281/1-800-330-2525 or, DEGESCH CANADA, INC. 514-852-3010. For all other chemical emergencies, please contact CHEMTREC – 1-800-424-9300 or Canadian Transport Emergency Centre (CANUTEC) 613-996-6666.

3. **TOXICOLOGICAL INFORMATION**

Magnesium phosphide Fumi-Cel plates or Fumi-Strips will react with moisture from the air, acids and many other liquids to release hydrogen phosphide (phosphine, PH₃) 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 appear within a few hours to several days. Severe poisoning may result in pulmonary edema (fluid in lungs) and may lead to dizziness, cyanosis (blue or purple skin colour), unconsciousness, and death.

In sufficient quantity, hydrogen phosphide affects the liver, kidneys, lungs, nervous system and circulatory system and may result in (1) pulmonary edema, (2) liver elevated serum AST, ALT and AIP, 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. 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). Poisonous if swallowed. Ingestion can cause lung and brain symptoms, but damage to the viscera (body cavity organs) is more common.

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

In its milder to moderate forms, symptoms of poisoning may take up to 24 hours to appear. Monitoring should continue for at least this long. Manifestations of severe poisoning appear early. Hypoxia and hypotension should be treated with usual supportive measures of oxygenation, intubation, ventilation and positive pressure as needed, and intravenous fluids, pressors and inotropes as required, respectively. In the event of the ingestion of a large quantity of magnesium phosphide, once the patient is stabilized, aspiration of gastric contents by inserting a 16 french naso-gastric tube to suction the stomach contents might be considered. There is no specific antidote. Hemodialysis may be indicated if renal failure develops but does not remove the toxin.

4. PRECAUTIONS

4.1 **DANGER: Hazardous to Humans, Birds and Mammals – KEEP OUT OF REACH OF CHILDREN AND PREVENT ACCESS BY UNAUTHORIZED PERSONNEL**

Magnesium phosphide from DEGESCH Fumi-Cel® plates and Fumi-Strip is fatal if swallowed. DO NOT ingest plates, strips or dust. Magnesium phosphide forms extremely hazardous gas that is fatal if inhaled. DO NOT inhale/breathe gas. Fatal if absorbed through eyes or skin. DO NOT get in eyes, on skin or on clothing. DO NOT eat, drink or smoke while handling magnesium phosphide fumigants. If a sealed container is opened, or if the material comes into contact with water, acids or other liquids these products will release hydrogen phosphide (phosphine, PH₃) which is an extremely toxic gas. The **FUMI-CEL®** plates and **FUMI-STRIP®** do not liberate ammonia and carbon dioxide since they contain no ammonium carbamate. If a garlic odour is detected, refer to the information on Industrial Hygiene Monitoring (Section 8.6) 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 entry procedures specified elsewhere in the labelling to prevent overexposure. In situations where ventilation of buildings is required following fumigation (e.g. warehouses), hydrogen phosphide gas may pose a potential hazard to small birds (e.g. swallows) nesting or roosting 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 or roosting birds.

4.2 **Physical and Chemical Hazards**

Magnesium phosphide Fumi-Cel plates and Fumi-Strip will release hydrogen phosphide gas 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 Fumi-Cel® Plates or Fumi-Strip® or the addition of liquid to the product is prohibited. This may cause a temperature increase, increase the rate of gas production and confine the gas so that ignition could occur.

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

Pure hydrogen phosphide (phosphine) gas is practically insoluble in water, fats and oils, and is stable at normal fumigation temperatures. However, hydrogen phosphide will corrode copper and precious metals at high concentrations or humidity levels. 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**

Toxic to birds and mammals. Carefully inspect the outside and inside of a structure prior to application of the fumigant to ensure the absence of nesting or roosting birds. Avoid application if birds are present. DO NOT contaminate irrigation or drinking water supplies or aquatic habitats such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands by cleaning of equipment or disposal of wastes.

5. **PROTECTIVE CLOTHING**

Wear a loose fitting long sleeve shirt, long pants, socks and shoes, and wear dry gloves of cotton or other breathable material if contact with Fumi-Cel plates or Fumi-Strips is likely. After fumigation activities, remove all protective clothing, check and ensure that there is no magnesium phosphide product trapped inside clothing, aerate in a well-ventilated area then wash thoroughly, separately, before re-use.

If magnesium phosphide dust become trapped inside clothing, remove affected clothing, place the collected trapped magnesium phosphide product in a sealable clean and dry plastic bag, store in a place that is inaccessible to any unauthorized personnel; and then wash hands and exposed skin thoroughly, shower and change into clean clothing. As much as possible, continue wearing the appropriate respiratory protection while handling magnesium phosphide fumigants.

6. **RESPIRATORY PROTECTION**

Entry by unprotected workers into the fumigated site is only permitted after the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. Only if necessary, should workers be present in the fumigation zone. All workers present in the fumigation zone during the fumigation or aeration periods MUST wear appropriate respiratory protection, as outlined below, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm. Each unprotected worker in the fumigation zone must have a personal hydrogen phosphide monitor that is functional for the duration of the work period, must know how to operate the personal hydrogen phosphide monitor and be informed of procedures required if the air levels of hydrogen phosphide gas exceed 0.1 ppm. NIOSH-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.

Appropriate respiratory protection MUST be worn at all times when levels of hydrogen phosphide are above 0.1 ppm, which may occur during delivery/dispensing of product, while attending to spills and leaks, during deactivation of unreacted product and while monitoring hydrogen phosphide levels during the fumigation and aeration periods. If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm, must be worn. Observe all Provincial pesticide legislation requirements. The respiratory protection must fit properly, any obstruction to a proper fit should be removed (e.g., beard, long sideburns).

For hydrogen phosphide levels between 0.1 – 5 ppm, the minimum protection required is a NIOSH-approved air-purifying, full face respirator (gas mask) with a chin-style, front- or back-mounted canister approved for hydrogen phosphide OR a NIOSH-approved supplied-air respirator (i.e., air-line respirator or self-contained breathing apparatus) with a full face piece.

For hydrogen phosphide levels above 5 ppm or at unknown concentrations, a NIOSH-approved self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode OR a NIOSH-approved air-line respirator with a full face piece operated in a pressure-demand or other positive-pressure mode combined with an auxiliary self-contained positive-pressure breathing apparatus must be worn.

For emergency use and/or to escape from conditions which are Immediately Dangerous to Life or Health (IDLH), keep available for use an adequate number of NIOSH-approved self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode.

Appropriate respiratory equipment is summarized in Table 6.0.

Table 6.0: Required Respiratory Equipment

Phosphine Level (PPM)	Minimum Required Respiratory Equipment
Unknown	Personal hydrogen phosphide monitor or respiratory equipment required for phosphine levels greater than 5 ppm.
>0.1 - <5 ppm	NIOSH-approved air-purifying, full face respirator (gas mask) with a chin-style, front- or back-mounted canister approved for hydrogen phosphide OR a NIOSH-approved supplied-air respirator (i.e., air-line respirator or self-contained breathing apparatus) with a full face piece.
>5 ppm	NIOSH-approved self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode OR a NIOSH-approved air-line respirator with a full face piece operated in a pressure-demand or other positive-pressure mode combined with an auxiliary self-contained positive-pressure breathing apparatus.
Emergency use or Immediately Dangerous to Life or Health Conditions	NIOSH-approved self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode.

When required, gas concentration measurements for safety purposes may be made using low level detector tubes or electronic metering devices*. See Section 9, APPLICATOR AND WORKER EXPOSURE, for monitoring requirements.

*Information on hydrogen phosphide (phosphine, PH₃) detector tubes or electronic metering devices may be obtained from your distributor.

7. FUMIGATION ZONE REQUIREMENTS

7.1 Fumigation Zones

A fumigation zone is an area established around the perimeter of the application site (fumigated site) where a hydrogen phosphide gas releasing fumigant is applied. A fumigation zone must be established according to the distances listed in **Section 7.2 Minimum Distance of Fumigation Zone** during the fumigation period (i.e., from the beginning of the fumigant application until the beginning of aeration). During aeration (i.e., from the beginning of aeration until the hydrogen phosphide level is at or below 0.1 ppm), the fumigation zone is determined by the licensed/certified applicator who MUST be present for the duration of the aeration period.

The following describes the general fumigation zone requirements:

- A fumigation zone must be established according to the distances listed in **Section 7.2 Minimum Distance of Fumigation Zone**.
- The fumigation zone must be periodically monitored (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions). If at any point the hydrogen phosphide level is greater than 0.1 ppm, the provisions in **Section 7.3 Extension of Fumigation Zone As A Result of Monitoring** must be followed.
- The fumigation zone must be maintained until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone.
- Individuals must be excluded from the fumigation zone to the extent possible. If entry into the fumigation zone is required at any point from the beginning of application until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone, the provisions in the **Section 7.4 Authorized Entry into Fumigation Zones** must be followed.
- Appropriate respiratory protection (as outlined in Section 6, RESPIRATORY PROTECTION) MUST be worn if entry into the fumigated site is required at any point from the beginning of application until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone.
- Ships and railcars which will be in transit post application are exempt from this requirement. Note: the transport of non-aerated commodities is permitted by rail or ship/barge only. Other transport vehicles such as trucks, vans, and trailers are prohibited from travel over public roads or highways until completely aerated to a hydrogen phosphide level at or below 0.1 ppm.
- The fumigation zone must extend from the perimeter of the application site equally in all directions.

7.2 Minimum Distance of Fumigation Zone

During the fumigation period (i.e., from the beginning of the fumigant application until the beginning of aeration) and the aeration period (i.e., from the beginning of aeration until the hydrogen phosphide level is at or below 0.1 ppm), the following minimum distances for the fumigation zone as outlined in Table 7.2 MUST be adhered to.

Table 7.2: Minimum Distance of Fumigation Zone		
SITE	Minimum Distance of Fumigation Zone	
	Fumigation Period	Aeration Period
Indoor Application Sites	10 metres OR all workers inside the facility MUST wear a personal hydrogen phosphide monitor.	Fumigation zone determined by licensed/certified applicator
Vessels	Fumigation zone determined by licensed/certified applicator	
Outdoor Application Sites	Fumigation zone determined by licensed/certified applicator	
Tarpaulins	30 metres OR boundary of the room	
Railcars	30 metres	

Indoor Application Sites: Any fumigation that is taking place within an enclosed structure (except for tarpaulins, see below), such as grain elevators/bins, warehouses, mills, food processing plants, flat houses, upright bins and bunkers. Also includes containers that are fumigated within a structure.

For indoor application sites, provided that all workers within the entire indoor structure are wearing a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm, a minimum fumigation zone of 10 metres does not need to be established. If at any time hydrogen phosphide levels exceed 0.1 ppm, all individuals who are not wearing respiratory protection as outlined in Section 6 MUST vacate the area until hydrogen phosphide levels are at or below 0.1 ppm.

Outdoor Application Sites: Any fumigation that is taking place outdoors (except for tarpaulins and railcars, see below), such as silos and containers, outdoor upright bins, and outdoor grain bins.

Tarpaulins: Includes tarpaulin fumigations that are taking place both indoors and outdoors. If the tarpaulin is located indoors in an enclosed room that is less than 30 metres, the fumigation zone is the boundary of the room.

Railcars: Refers to the fumigation of the actual railcar, if a container is being fumigated on the railcar, then the fumigation would be part of the outdoor application sites category.

During the aeration period (i.e., from the beginning of aeration until the hydrogen phosphide level is at or below 0.1 ppm), the fumigation zone is determined by the licensed/certified applicator who MUST be present for the duration of the aeration period.

7.3 Extension of Fumigation Zone As A Result of Monitoring

During the fumigation period (i.e., from the beginning of the fumigant application until the beginning of aeration), a supervising fumigant applicator/handler or someone who has been trained by the certified applicator must periodically monitor hydrogen phosphide levels at several locations along the fumigation zone perimeter (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions). During the aeration period (i.e., from the beginning of aeration until the hydrogen phosphide level is at or below 0.1 ppm), the licensed/certified applicator must periodically monitor hydrogen phosphide levels at several locations along the fumigation zone perimeter (i.e., according to a schedule as per site characteristics and environmental conditions).

If at any time the person monitoring hydrogen phosphide levels detects concentrations greater than 0.1 ppm, the area must immediately be cleared of all individuals who are not wearing respiratory protection as outlined

in Section 6, and the fumigation zone must be extended until the hydrogen phosphide is at or below 0.1 ppm along the perimeter. If an extension of the fumigation zone is not feasible, appropriate measures must be implemented (e.g. cease the delivery/dispensing of product, sealing of leaks, limiting aeration) until the hydrogen phosphide level is at or below 0.1 ppm at the fumigation zone perimeter at which time fumigation activities may continue.

7.4 **Authorized Entry into Fumigation Zones**

Only if necessary, should authorized pesticide applicators/handlers or workers be present in the fumigation zone. All workers (including authorized pesticide applicators/handlers) in the fumigation zone during fumigation and until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone, **MUST** wear respiratory protection as outlined in the RESPIRATORY PROTECTION section OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm. Each unprotected worker in the fumigation zone must know how to operate the personal hydrogen phosphide monitor and be informed of procedures required if the levels of hydrogen phosphide gas exceed 0.1 ppm. If at any time hydrogen phosphide levels exceed 0.1 ppm, all individuals who are not wearing respiratory protection as outlined in Section 6 **MUST** vacate the area until hydrogen phosphide levels are at or below 0.1 ppm.

7.5 **Placarding of Fumigation Zones**

The fumigation zone must be placarded as outlined in Section 10, PLACARDING OF FUMIGATION AREAS.

8. **MANDATORY ANNUAL TRAINING**

8.1 **Responsible Parties**

- Certified/Licensed Applicator: Responsible for informing the person in charge of the facility or agricultural establishment, the employer or his/her representative of the requirement for the mandatory training and maintenance of training records, and directing the person in charge of the facility or agricultural establishment, the employer or his/her representative on how to obtain a copy of the product-specific training material from the manufacturer.
- Manufacturer: Responsible for having the product-specific training material readily available upon request.
- The person in charge of the facility or agricultural establishment or the employer or his/her representative is responsible for:
 - o Developing site-specific training material.
 - o Providing both product-specific and site-specific training to workers.
 - o Maintaining training records for their employees/workers for a minimum of two years.

8.2 **Personnel**

In facilities or agricultural establishments (i.e., farms) where this product is used, all employees (i.e., all individuals such as workers, contractors, handlers, farmers, and farm workers) who are present in the facility or agricultural establishment during product use, **MUST** complete mandatory annual training using product-specific training material supplied by the manufacturer, and additional facility-specific information developed by the employer or his/her representative.

8.3 **Mandatory Training Elements**

The training material **MUST** include the following information:

Hazards of Hydrogen Phosphide Gas: Phosphine-releasing products are classified as restricted-class products due to the high acute toxicity of phosphine gas. Signs and symptoms of phosphine exposure are summarized as follows:

Symptoms of mild exposure include:

- Malaise (indefinite feeling of sickness), ringing in the ears, fatigue, nausea, and pressure in the chest.

Symptoms of moderate poisoning include:

- Weakness, vomiting, pain just above the stomach, chest pain, diarrhea, and difficulty breathing.

Symptoms of severe poisoning include:

- Dizziness, blue/purple skin colour, unconsciousness and death.
- High exposure to phosphine may also lead to fluid in the lungs, and effects on the liver, kidneys, lungs, nervous system and circulatory system.
- Note: Symptoms of severe poisoning may appear within a few hours to several days.

The 0.1 ppm Exposure Limit: Information on the 0.1 ppm exposure limit and that it is not a time-weighted average threshold limit value. Workers MUST NOT be exposed to phosphine levels above 0.1 ppm for any duration of time. Frequent exposure to concentrations above permissible levels over a period of days or weeks may cause poisoning.

How to Use Personal Hydrogen Phosphide Monitors and Personal Protective Equipment: Information on facility-specific equipment, such as how to calibrate and use personal hydrogen phosphide monitors, and proper fit-testing of respirators. In addition, information on when respiratory protection should be used must be included.

Procedures when Levels of Hydrogen Phosphide Gas Exceed 0.1 ppm: Facility-specific details on what to do when hydrogen phosphide levels exceed 0.1 ppm, where workers are to go, who they should contact and where personal protective equipment is located.

9. APPLICATOR AND WORKER EXPOSURE

9.1 Hydrogen Phosphide Exposure Limits

Exposure to hydrogen phosphide must never exceed 0.1 ppm. Entry by unprotected workers into the fumigated site is only permitted after the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. Only if necessary, should workers be present in the fumigation zone. All workers present in the fumigation zone during the fumigation or aeration periods MUST wear appropriate respiratory protection, as outlined in the Applicator's Manual – RESPIRATORY PROTECTION OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm. Each unprotected worker in the fumigation zone must have a personal hydrogen phosphide monitor that is functional for the duration of the work period, must know how to operate the personal hydrogen phosphide monitor and be informed of procedures required if the air levels of hydrogen phosphide gas exceed 0.1 ppm. All persons in the fumigated site and the fumigation zone are covered by this 0.1 ppm exposure safety limit. Periodic gas measurements should be made in the worker's breathing zone using hydrogen phosphide low level detector tubes or electronic metering devices, unless they are protected by a NIOSH-approved self-contained breathing apparatus with full face piece operated in a pressure-demand or other positive-pressure mode OR a NIOSH-approved air-line respirator with a full face piece operated in a pressure-demand or other positive-pressure mode combined with an auxiliary self-contained positive-pressure breathing apparatus.

The level of hydrogen phosphide 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.

9.2 Application of Fumigant

Depending upon temperature and humidity levels, DEGESCH Fumi-Cel® plates and Fumi-Strip will release hydrogen phosphide gas slowly upon exposure to moisture from the air. Appropriate respiratory protection, as outlined under Section 6, RESPIRATORY PROTECTION, MUST be worn at all times when levels of hydrogen phosphide are above 0.1 ppm. If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm MUST be worn. If at any time hydrogen phosphide levels exceed 0.1 ppm, all individuals who are not wearing respiratory protection as outlined in Section 6 MUST vacate the area until hydrogen phosphide levels are at or below 0.1 ppm. For safety purposes, monitoring of hydrogen phosphide levels during fumigation is required and may be conducted using low level detector tubes or electronic metering devices according to

the information on Industrial Hygiene Monitoring in Section 9.6 of this Applicator's Manual.

9.3 **Leakage from Fumigated Sites**

Hydrogen phosphide gas 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 must be monitored using phosphine detector tubes or electronic metering devices to ensure that significant leakage has not occurred. Sealing of the fumigated site, establishment of a fumigation zone, and/or air flow in the occupied areas must be sufficient to meet the 0.1 ppm exposure safety limit.

9.4 **Aeration and Reentry**

If the fumigated site is to be entered after fumigation, it must be aerated until the level of hydrogen phosphide gas is at or below 0.1 ppm in the fumigated site and the fumigation zone. Otherwise appropriate respiratory protection (as outlined in Section 6, RESPIRATORY PROTECTION) must be worn.

The fumigated site must be periodically monitored (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions) for hydrogen phosphide levels as well as at several locations along the fumigation zone perimeter to ensure that liberation of gas from the treated commodity does not result in the development of unacceptable levels of hydrogen phosphide. If at any time the licensed/certified applicator detects concentrations greater than 0.1 ppm, the area must immediately be cleared of all individuals who are not wearing respiratory protection as outlined in Section 6, and the fumigation zone must be extended until levels are at or below 0.1 ppm along the perimeter. If an extension of the fumigation zone is not feasible, appropriate measures must be implemented (e.g. sealing of leaks, limiting aeration) until the hydrogen phosphide level is at or below 0.1 ppm at the fumigation zone perimeter at which time fumigation activities may continue.

Adhere to provincial ambient air quality criteria standards and monitor gas levels. Ensure that the fumigated site and the fumigation zone are secure and placarded to prevent public and unauthorized worker access.

9.5 **Handling Un-Aerated Commodities**

Exposure to hydrogen phosphide must never exceed 0.1 ppm during moving, storage or processing of incompletely aerated commodities by unprotected workers. If levels exceed 0.1 ppm, appropriate respiratory protection as outlined in Section 6, RESPIRATORY PROTECTION must be worn. If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.

The level of hydrogen phosphide 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.

9.6 **Industrial Hygiene Monitoring**

At each site and operation under fumigation, monitor airborne hydrogen phosphide concentrations in all areas to which fumigators and other workers have had access during fumigation and aeration. Perform such monitoring in workers' breathing zones. This monitoring is performed to determine when and where respiratory protection is required. When monitoring for hydrogen phosphide levels, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm MUST be worn. Periodic gas measurements in those areas must be taken to determine whether conditions have significantly changed or if an unexpected garlic-like odour is present. Record all monitoring data in an operation log or manual.

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 or electronic metering devices are available which can detect 0.1 ppm and are suitable for industrial hygiene monitoring. Information on hydrogen phosphide (phosphine, PH₃) detector tubes or electronic metering devices may be obtained from your distributor.

10. **PLACARDING OF FUMIGATION AREAS**

IMPORTANT: Post warning placards around both the application site (fumigated site) and the fumigation

zone perimeter before the actual fumigation treatment. Relocating the placards may be required if the fumigation zone needs to be extended at any point during the fumigation or aeration period.

The licensed/certified applicator must placard or post warning signs at all usual points of entry and along other likely routes of approach where people not under the land operator's control may be in close proximity to the fumigated site and the fumigation zone. Placards should be placed in advance of the fumigation to keep unauthorized persons away. Some examples of points of entry include, but are not limited to, roadways, sidewalks, paths, and bike trails. Some examples of likely routes of approach are the area between a fumigation zone site and a roadway, or the area between a fumigation zone site and a housing development.

Posting of warning signs for the fumigation zone perimeter is required, UNLESS there is a physical barrier (e.g. fence) that prevents access into the fumigation zone. Signage must not be removed until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. Only a licensed/certified applicator can authorize removal of warning signs.

Placards must be at least 28 cm long and 21 cm wide and made of substantial material that can be expected to withstand adverse weather conditions. They must bear the following information:

1. The signal word DANGER in letters at least 7cm high and the SKULL AND CROSSBONES symbol in red.
2. The "DO NOT WALK" symbol.
3. The statement "Area and/or commodity under fumigation, DO NOT ENTER".
4. The date and time when fumigation begins and the date and time when aeration can begin.
5. Name and registration number of fumigant used: DEGESCH Fumi-Cel®/Fumi-Strip; Registration No. 26188.
6. Contact information (name, address and telephone number) for the supervising fumigant handler in charge of the fumigation.
7. Placards must bear a 24-hour emergency response telephone number.

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.

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 the hydrogen phosphide gas concentration is above 0.1 ppm. Trucks, vans, trailers and similar transport vehicles cannot be moved over public roads or highways until they are aerated and the warning placards removed. If workers must handle incompletely aerated commodity, or are indoors (e.g. an enclosed elevator head) they are to wear appropriate respiratory protection (refer to Section 6, RESPIRATORY PROTECTION).

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

It is recommended that the trained persons, under the supervision of a licensed/certified applicator, 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.

11. FUMIGATION MANAGEMENT PLAN

A FUMIGATION MANAGEMENT PLAN MUST BE WRITTEN FOR ALL FUMIGATIONS PRIOR TO ACTUAL TREATMENT

A fumigation management plan template is available from the manufacturer.

A Fumigation Management plan must be devised to cover application and exposure period, aeration and disposal of the fumigant so as to keep to a minimum any human exposures to hydrogen phosphide and to help ensure adequate control of pests.

The licensed/certified applicator is responsible for working with the owners and/or responsible employees of the site to be fumigated to develop and follow a Fumigation Management Plan. The Fumigation Management Plan is intended to ensure a safe and effective fumigation. The Fumigation Management Plan must address characterization

of the site, and include appropriate monitoring and notification requirements, and include a record that the following have been completed:

1. Inform the person in charge of the facility where the fumigation will take place that all workers must complete mandatory annual training as outlined in the Applicator's Manual – MANDATORY ANNUAL TRAINING. Training includes information on the hazards of the product, the use of safety equipment (i.e., respiratory protection and personal monitors), and the exposure limit of 0.1 ppm.
2. Inspect the site to determine its suitability for fumigation.
3. When sealing is required, consult previous records for any changes to the site/structure, seal leaks, and monitor any occupied adjacent buildings to ensure safety.
4. Prior to each fumigation, review any existing Fumigation Management Plan, MSDS, Applicator's Manual and other relevant safety procedures with company officials and appropriate employees.
5. Consult company officials in the development of procedures and appropriate safety measures for nearby workers that will be in and around the area during application and aeration.
6. Consult with company officials to ensure that an appropriate monitoring plan will be in place to confirm that nearby workers and bystanders will not be exposed to levels above the allowed hydrogen phosphide safety limit (i.e. 0.1 ppm) during application, fumigation and aeration. This plan must take into consideration all of the fumigation zone requirements and demonstrate that nearby residents will not be exposed to concentrations above the allowable limits.
7. Consult with company officials to develop procedures for local authorities to notify nearby residents in the event of an emergency.
8. Confirm the placement of placards to secure entrance and along other routes of approach into any site under fumigation and along the fumigation zone perimeter.
9. Confirm the required safety equipment is in place and the necessary manpower is available to complete a safe and effective fumigation.
10. Written notification must be provided to the receiver of a vehicle that is fumigated in transit (i.e., fumigation in transit is permitted by rail or ship only).

It is important to note that some Fumigation Management Plans will be more comprehensive than others. All Fumigation Management Plans should reflect the experience and expertise of the licensed/certified applicator and circumstances at and around the site/structure and the fumigation zone.

In addition to the development of the Fumigation Management Plan, the licensed/certified applicator must read the entire label and the Applicator's Manual and follow its directions carefully. If the licensed/certified applicator has any questions about the development of a Fumigation Management Plan, contact the product manufacturer for further assistance.

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

GUIDANCE FOR PREPARATION OF A FUMIGATION MANAGEMENT PLAN

Purpose

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

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

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

and regulations. The success of the fumigation is not only dependent on your ability to do your job but also upon carefully following all rules, regulations and procedures required by governmental agencies.

A CHECKLIST GUIDE FOR A FUMIGATION MANAGEMENT PLAN

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

A. PRELIMINARY PLANNING AND PREPARATION

1. Determine the purpose of the fumigation.
 - a. Control of insect infestation
 - b. Control of vertebrate pests
 - c. Plant pest quarantine
2. Determine the type of fumigation. For example:
 - a. Space: tarp, mill, warehouse, food processing plant,
 - b. Vehicle: railcar, truck, van, container
 - c. Commodity: raw agricultural or processed foods or non-food
 - d. Type of storage: vertical silo, farm storage, flat storage, etc.
 - e. Vessels: ship or barge. In addition to the Applicator's Manual, read the Cargo, Fumigation and Tackle Regulations under the Canada Shipping Act, current to August 5, 2014.
3. Fully acquaint yourself with the site and commodity to be fumigated, including:
 - a. The general structure layout, construction (materials, design, age, maintenance), of the structure, fire or combustibility hazards, connecting structures and escape routes, above and below ground, and other unique hazards or structural characteristics. Prepare, with the owner/operator/person in charge, a drawing or sketch of structure to be fumigated, delineating features, hazards, and other structural characteristics.
 - b. The number and identification of persons who routinely enter the area to be fumigated (i.e. employees, visitors, customers, etc.)
 - c. The specific commodity to be fumigated, its mode of storage, and its condition.
 - d. The previous treatment history of the commodity, if available.
 - e. Accessibility of utility service connections
 - f. Nearest telephone or other means of communication. Mark the location of these items on the drawing/sketch.
 - g. Emergency shut-off stations for electricity, water and gas. Mark the location of these items on the drawing/sketch.
 - h. Current emergency telephone numbers of local health, fire, police, hospital and physician responders.
 - i. Name and phone number (both day and night) of appropriate company officials.
 - j. Check, mark and prepare the points of fumigant application locations if the job involves entry into the structure for fumigation.
 - k. Review labeling and Applicator's Manual
 - l. Location of command centre
 - m. Exposure time considerations:
 1. Product (plates or strips) to be used
 2. Minimum fumigation period, as defined and described by the label use directions.
 3. Down time required to be available
 4. Aeration requirements
 5. Cleanup requirements, including dry or wet deactivation methods, equipment, and personnel needs, if necessary.
 6. Measured and recorded commodity temperature and moisture
 - n. Determination of dosage:
 1. Cubic footage or other appropriate space/location calculations
 2. Structure sealing capability and methods
 3. Label recommendations

4. Temperature, humidity, wind
5. Commodity/space volume
6. Past history of fumigation of the site/structure
7. Exposure time
8. Amount of fumigant used
9. Actual concentration achieved
- o. Distance to other on-site and neighbouring off-site structures, recreational areas or areas where bystanders may be exposed.
- p. Site of aeration vent(s) to be opened to aerate site/structure.
- q. Fumigation zone requirements, including provisions for areas not under the control of the owner/operator of the application site (e.g. agricultural areas, roads and rights-of-way, publically owned and/or operated areas, difficult to evacuate sites and other residential areas).

B. PERSONNEL

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

C. MONITORING

1. Safety
 - a. Scheduled ambient air monitoring of hydrogen phosphide concentrations must be conducted, downwind, along the fumigation zone perimeter to prevent exposure of unprotected workers and bystanders to concentrations of hydrogen phosphide greater than 0.1 ppm*** and to determine where exposures may occur. It may be necessary to monitor gas levels in other areas as well. Document where monitoring will occur.
 - b. Monitor (and record) the wind direction and adjust the hydrogen phosphide monitoring if wind direction changes over the fumigation/aeration period.
 - c. Keep a log or manual of monitoring records for each fumigated site and the fumigation zone. This log must, at a minimum, contain the timing, number of readings taken and level of concentrations found in each location.
 - d. When monitoring, document any hydrogen phosphide level even if it is present below the limit of detection.
 - e. From the beginning of the fumigant application and until the end of the fumigation period, a supervising fumigant applicator/handler or someone under his/her supervision must periodically monitor (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions) hydrogen phosphide levels at several locations along the fumigation zone perimeter. During aeration (i.e., from the beginning of aeration until hydrogen phosphide concentrations are equivalent to or less than 0.1 ppm), the licensed/certified applicator must periodically monitor (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions) hydrogen phosphide levels at several locations along the fumigation zone perimeter.

If at any time the person monitoring hydrogen phosphide levels detects hydrogen phosphide concentrations greater than 0.1 ppm, the area must immediately be cleared of all individuals who are not wearing respiratory protection as outlined in Section 6, and the fumigation zone must be extended until the hydrogen phosphide level is at or below 0.1 ppm along the perimeter. If an extension of the fumigation zone is not feasible, appropriate measures must be implemented (e.g. cease the delivery/dispensing of product, sealing of leaks, limiting aeration, etc.) until such time that the hydrogen phosphide level is at or below 0.1 ppm at the fumigation zone perimeter at which time fumigation activities may continue.

*****NOTE: An evacuation action may be necessary when hydrogen phosphide levels exceed 0.1 ppm.** To determine hydrogen phosphide levels, readings may be taken using low level detector tubes or electronic metering devices.

2. Efficacy

- a. Hydrogen phosphide readings should be taken from within the fumigated site and/or structure to ensure proper gas concentrations, along with temperature and relative humidity readings. Readings must be taken immediately after introduction of the product, six hours after the introduction of the product followed by a reading every twelve hours during the fumigation period. Finally, hydrogen phosphide readings should be taken every thirty minutes until aeration is complete. Refer to Section 12, DIRECTIONS FOR USE for detailed information.
- b. All hydrogen phosphide, temperature and relative humidity readings should be documented.

D. NOTIFICATION

1. Confirm all the appropriate local authorities (fire departments, police departments, etc.) have been notified as per label instructions, local ordinances, or instructions of the client.
2. Prepare written procedure ("Emergency Response Plan"), which contains explicit instructions, names, and telephone numbers so as to be able to notify local authorities if hydrogen phosphide levels are exceeded in an area that could be dangerous to bystanders and/or domestic animals. Elaborate in this section the key elements of an Emergency Response Plan including reference to evacuation procedures, etc. Evacuation procedures must take into consideration any difficult-to-evacuate sites, which may take longer to evacuate. Difficult-to-evacuate sites are defined as schools (preschool to grade 12), provincially licensed day care centres, nursing homes, assisted living facilities, hospitals, in-patient clinics and prisons.
3. Confirm that the receiver of in-transit vehicles under fumigation have been notified and are trained according to Section 12.6.4, Fumigation of Railcars, Containers, Trucks, Vans and Other Transport Vehicles Shipped Piggyback by Rail, of this Applicator's Manual.

E. SEALING PROCEDURES

1. Sealing must be adequate to control the pests. Care should be taken to ensure that sealing materials will remain intact until the fumigation is complete.
2. If the site has been fumigated before, review the previous Fumigation Management Plan for previous sealing information.
3. Make sure that construction/remodeling has not changed the site/structure in a manner that will affect the fumigation.
4. Warning placards must be placed to secure any entrance into the fumigated site and along other likely routes of approach.

F. APPLICATION PROCEDURES AND FUMIGATION PERIOD

1. Plan carefully and apply the product in accordance with the label requirements.
2. At least two persons, a licensed/certified applicator and trained person, or two persons trained in accordance with the Applicator's Manual working under the direct supervision of the licensed/certified applicator must be present during fumigation of structures when entry into the structure for application of the fumigant is required. Appropriate respiratory protection, as outlined in Section 6, RESPIRATORY

PROTECTION, MUST be worn at all times when levels of hydrogen phosphide are above 0.1 ppm, which may occur during delivery/dispensing of product, while attending to spills and leaks and while monitoring hydrogen phosphide levels during the fumigation period. If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.

3. Apply fumigant from the outside when and where appropriate.
4. Provide watchmen when you cannot secure the fumigated site and the fumigation zone from entry by unauthorized persons (e.g., by secondary locks, barricades, etc.) during the fumigation process.
5. When entering sites/structures, always follow applicable provincial legislation for confined spaces.
6. Document that the receiver of transport vehicles shipped piggyback by rail and/or shipping containers fumigated in-transit has been notified.
7. Turn off any electric lights in the fumigated site and/or structure, as well as all non-essential electrical motors.

G. POST-APPLICATION OPERATIONS

1. Provide watchmen when you cannot secure the fumigated site and the fumigation zone from entry (e.g., by secondary locks, barricades, etc.) by unauthorized persons during the aeration process.
2. Ventilate and aerate the fumigated site in accordance with site and/or structural limitations and nearby occupied areas so as to minimize bystander exposure.
3. Turn on ventilating or aeration fans where appropriate.
4. Determine hydrogen phosphide gas concentration in the fumigated environment from outside if possible. As much as possible, limit exposure. As much as possible limit exposure, for example, by using monitoring equipment that measures indoor concentrations and displays results outside of the fumigated site. Use a sufficiently sensitive gas detector before entry into a fumigated site and/or structure to determine fumigant concentration.
5. During aeration, monitor gas levels periodically (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions) until the fumigated site and/or structure is ready for entry.
6. Keep written records of monitoring to document completion of aeration.
7. Consider temperature when aerating.
8. Ensure that aeration is complete before moving treated transport vehicles onto public roads.
9. Remove fumigation warning placards, when authorized by a licensed/certified applicator, after aeration of the fumigated site is complete and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone as determined by using a detection device of sufficient sensitivity.
10. Inform business/client that employees/other persons may return to work or otherwise be allowed to enter the aerated site and/or structure.

12. DIRECTIONS FOR USE

12.1 General

It is a violation of the Pest Control Products Act to use this product in a manner inconsistent with its labeling.

- 12.1.1 The use of DEGESCH Fumi-Cel® plates and Fumi-Strip is RESTRICTED due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH₃) gas, which is formed when this product is exposed to moisture in the air. These products are for retail sale to and use only by individuals holding an appropriate pesticide applicator certificate or license recognized by the provincial/ter-

ritorial pesticide regulatory agency where the pesticide application occurs or by persons trained in accordance with the Applicator's Manual working under the direct supervision and in the physical presence of an applicator holding an appropriate pesticide applicator certificate or license. 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.

- 12.1.2 A fumigation zone must be established for all fumigated sites (with the exception of ships and railcars that are in motion) as per the instructions outlined under Section 7, FUMIGATION ZONE REQUIREMENTS. Prior to entry by unprotected workers, the fumigated site must be aerated and the hydrogen phosphide level must be at or below 0.1 ppm in the fumigated site and the fumigation zone.

- 12.1.3 Magnesium phosphide is a highly hazardous material and should be used only by individuals trained in its proper use. Before using, read and understand the entire label and this Applicator's Manual and follow all precautions, safety recommendations and directions.

Persons working with magnesium phosphide must 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.

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

DEGESCH America, Inc.
153 Triangle Drive
P. O. Box 116
Weyers Cave, VA 24486
Telephone: 540-234-9281/1-800-330-2525
Fax: 540-234-8225
Internet: www.degeschamerica.com
E-Mail: degesch@degeschamerica.com

Degesch Canada, Inc.
8685 Rue Lafrenaie
Saint-Léonard, QC
Canada H1P 2B6
Telephone: 514-852-3010

- 12.1.4 Except in the case of an emergency, there is no need to enter a structure which is being fumigated using DEGESCH Fumi-Cel® plates and Fumi-Strip. At least two persons, a licensed/certified applicator and trained person, or two persons trained in accordance with the Applicator's Manual working under the direct supervision of the licensed/certified applicator must be present during fumigation of structures when entry into the structure for application of the fumigant is required.

Appropriate respiratory protection, as outlined in Section 6, RESPIRATORY PROTECTION, MUST be worn at all times when levels of hydrogen phosphide are above 0.1 ppm, which may occur during delivery/dispensing of product, while attending to spills and leaks, during deactivation of incompletely reacted Plates and Strips and while monitoring hydrogen phosphide levels during fumigation and aeration periods. If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm, must be worn. The licensed/certified applicator must maintain visual and/or voice contact with all fumigation workers during the application of the fumigants.

Large scale fumigations may require the posting of watchmen to prevent entry into the site under fumigation and the fumigation zone. Refer to Provincial pesticide regulations.

- 12.1.5 Shipholds, barges, containers on ships, railroad cars 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.

Trucks, vans, trailers and similar transport vehicles are prohibited from travel over public roads or highways until completely aerated to a hydrogen phosphide level at or below 0.1 ppm and the warning placards removed.

- 12.1.6 The site to be fumigated must first be inspected to determine if it can be made sufficiently gas tight. Then a Fumigation Management Plan must be developed prior to actual treatment to provide

for safe and efficient application of the fumigant to include emergency procedures, etc., and to decide how monitoring should be conducted to prevent excessive exposures (refer to Section 10, FUMIGATION MANAGEMENT PLAN). Hydrogen phosphide gas may be hazardous to birds nesting or roosting on or near warehouses. Carefully inspect the outside of the structure prior to application of the fumigant to ensure the absence of nesting or roosting birds.

- 12.1.7 Wear a loose fitting long sleeve shirt, long pants, socks and shoes, and wear dry gloves of cotton or other breathable material while handling magnesium phosphide products®. Wash hands thoroughly after use. After fumigation activities, remove all protective clothing, check and ensure that there are no magnesium phosphide products trapped inside clothing, aerate in a well-ventilated area then wash thoroughly, separately, before reuse.
- 12.1.8 Hydrogen phosphide gas may flash at concentrations above its flammable limit. Do not open FUMI-CEL plates and FUMISTRIP containers in an explosive environment (e.g. flour mill). Always open pouches of metal phosphide fumigants in open air and never 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.
- 12.1.9 Contact with water, acids or other liquids is prohibited when applying **FUMI-CEL®** plates and **FUMI-STRIP®** treatment of bulk commodities or space. Liquids in contact with unreacted magnesium phosphide will greatly accelerate the production of hydrogen phosphide gas which would result in a toxic and/or fire hazard.
- 12.1.10 Piling of Fumi-Cel plates, Fumi-Strip, dust from their fragmentation or the addition of liquid to the product is prohibited. Liquid may speed up the reaction, cause a temperature increase and confine the gas so that ignition could occur.
- 12.1.11 As much as is possible, protect unused Plates and Strips from excessive exposure to atmospheric moisture during application.
- 12.1.12 Hydrogen phosphide gas may react with certain metals and their salts to produce corrosion. This gas is corrosive to copper, copper alloys and precious metals such as silver and gold. Sensitive equipment and items containing these elements should be removed or protected prior to fumigation with magnesium phosphide.
- 12.1.13 Under no circumstances shall any processed food, feed or bagged commodity come into direct contact with Degesch Fumi-Cel® Plates, Fumi-Strip or residual dust, or a raw agricultural commodity that will be used directly as a food without further processing.
- 12.1.14 If Fumi-Cel/Fumi-Strip is to be applied from within the structure to be fumigated, approved respiratory protection must be worn by all personnel in the structure (refer to Section 6, RESPIRATORY PROTECTION).

Respiratory protection approved for the concentration to which the fumigator will be exposed to must be worn. For hydrogen phosphide levels between 0.1 - 5 ppm, the minimum protection required is a NIOSH-approved air-purifying full face respirator (gas mask) with a chin-style front- or back-mounted canister approved for hydrogen phosphide OR a NIOSH-approved supplied-air respirator (i.e., air-line respirator or self-contained breathing apparatus) with a full face piece.

For hydrogen phosphide levels above 5 ppm or at unknown concentrations, a NIOSH-approved self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode OR a NIOSH-approved air-line respirator with a full face piece operated in a pressure-demand or other positive-pressure mode combined with an auxiliary self-contained positive-pressure breathing apparatus must be worn.

For emergency use and/or to escape from conditions which are Immediately Dangerous to Life or Health (IDLH), keep available for use an adequate number of NIOSH-approved self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode.

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

12.2. Pests Controlled

Fumi-Cel® plates and Fumi-Strip have been found effective against the following pests, including pre-adult stages – (eggs, larvae and pupae) of insect pests:

Almond moth	Flat grain beetle	Mice
Angoumois grain moth	Flour beetle	Nematodes
Bean weevil	Fruit flies (small)	Pink bollworm
Bees	Grain moth	Raisin moth
Cadelle	Granary weevil	Red flour beetle
Cereal leaf beetle	Greater wax moth	Rice weevil
Cigarette beetle	Hairy fungus beetle	Rodents
Cockroaches	Hessian fly	Rusty grain beetle
Confused flour beetle	Indian meal moth	Saw-toothed grain beetle
Dermostid 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 mealworm
European grain moth	Merchant grain beetle	

Rodent pests may be controlled using Fumi-Cel® Plates and Fumi-Strip®. Although it is possible to achieve total control of the listed 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 pests 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.

12.3 Fumigant 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 FUMI-CEL® & FUMI-STRIP®
TEMPERATURE EXPOSURE PERIOD

below 5°C (40°F)	Do not fumigate*
5° - 12°C (40° - 53°F)	4 days (96 hours)
13° - 15°C (54° - 59°F)	3 days (72 hours)
16° - 20°C (60° - 68°F)	2 days (48 hours)

*If the temperature drops below 5°C during a fumigation, deactivate the Fumi-Cel® plates and Fumi-Strip® at the end of the fumigation period, as detailed in the SPILL AND LEAK PROCEDURES (Section 15).

The length of the fumigation must be great enough so as to provide for adequate control of the pests which infest the commodity being treated. Additionally, the fumigation period should be long enough to allow for complete reaction of DEGESCH Fumi-Cel plates or Fumi-Strip with moisture so that little or no unreacted magnesium phosphide remains. This will minimize worker exposures during further storage and/or process-

ing of the treated bulk commodity as well as reduce hazards in the disposal of partially spent magnesium phosphide products remaining after space fumigations. The proper length of the fumigation period will vary with exposure conditions since, in general, pests are more difficult to control at lower temperatures and the rate of hydrogen phosphide gas production by **FUMI-CEL®** plates and **FUMI-STRIP®** is lower at lower temperatures and humidity levels.

It should be noted that there is little to be gained by extending the exposure period if the site/structure to be fumigated has not been carefully sealed or if the distribution of gas is poor and pests 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 sites/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 Fumi-Cel®/Fumi-Strip, particularly if temperatures and commodity moisture levels or humidity are low during the fumigation. **Since they are more reactive, magnesium phosphide fumigants such as FUMI-CEL® plates, and FUMI-STRIP® are the products of choice under condition of lower temperatures and/or low humidity.**

12.4 **Commodities Which May be Fumigated with Fumi-Cel® Plates and Fumi-Strip®**

Fumi-Cel® plates and Fumi-Strip may be used for the fumigation of listed raw agricultural commodities, animal feed, processed foods, tobacco and certain other non-food items. Under no circumstances shall any processed food, feed or bagged commodity come into direct contact with Fumi-Cel plates, Fumi-Strip, residual dust or a raw agricultural commodity that will be used directly as a food without further processing.

12.4.1 **Raw Agricultural Commodities, Animal Feed and Feed Ingredients**

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

Raw Agricultural Commodities include all food commodities at farm gate or harvest, i.e. not processed.

12.4.2 **Processed Foods**

The listed processed foods may be fumigated with **FUMI-CEL®** plates and **FUMI-STRIP®**. Under no condition shall any processed food or bagged commodity come in contact with residual dust from plates or strips.

Processed Foods Which May Be Fumigated With FUMI-CEL® plates and FUMI-STRIP®

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 By-products
 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)

12.4.3 **Non-Food Commodities, Including Tobacco**

The listed nonfood items may be fumigated with **FUMI-CEL®** plates and **FUMI-STRIP®**. Tobacco, psyllium seed and psyllium seed husks intended for drug use and certain other of the nonfood commodities should not be contacted by residual dust from metal phosphide fumigants. 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, etc.) prior to shipment. In addition, psyllium seed and husks may be fumigated at other locations only under direct instructions from the pharmaceutical company.

Non-Food Commodities Which May Be Fumigated With FUMI-CEL® Plates and FUMI-STRIP®

- 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
- Tires (for mosquito control)
- Tobacco
- Wood, Cut Trees, Wood Chips and Wood and Bamboo Products
- Paper and Paper Products
- Psyllium Seed and Psyllium Seed Husks intended for drug use
- Dried Plants and Flowers
- Seeds (grass seed, ornamental herbaceous plant seed and vegetable seed)

12.5 **Recommended Dosages**

Hydrogen phosphide is a mobile gas and will penetrate to all parts of the storage site/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 number of Plates or Strips are required to treat a 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 ranges **are one FUMI-CEL® plate (33 g of hydrogen phosphide) per 6.5 to 46 cubic metres and one FUMI-STRIP® (660 g of hydrogen phosphide) per 130 to 934 cubic metres. Note: The maximum dosage for dates, nuts and dried fruits is one FUMI-CEL® plate per 23 cubic metres or one FUMI-STRIP® per 467 cubic metres.** These dosages are 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.

The wide range of dosages listed above is required to handle the variety of fumigation situations encountered in practice. Somewhat higher dosages are usually recommended under cooler, drier conditions or where exposure periods are relatively short. However, the major factor in selection of dosage is the ability of the site/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 site/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 range of dosages listed above, the following dosage ranges are recommended for the various types of fumigations:

Recommended Dosages for Various Types of Fumigations

	Volume Range	
	<u>Cubic Metres/FUMI-CEL®</u>	<u>Cubic Metres/FUMI-STRIP®</u>
1. Space		
mills, warehouses, etc.	15-46	308-924
bagged commodities	15-31	308-616
processed dried fruits & nuts	23-46	462-924
stored tobacco	23-46	462-924
2. Bulk Stored Commodities		
vertical storages	15-31	308-616
tanks	13-31	263-616
flat storages (loose construction)	6.5-18.5	130-370
farm bins	6.5-13	135-263
bunkers & tarped ground storages	11.5-31	230-616
railcars, containers, trucks	14-31	285-616
barges	6.3-18.5	130-370
ship holds	14-31	280-616

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.

12.6 Application Procedures

12.6.1 General Statement

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). Note that transport of non-aerated commodities is permitted by rail or ship only. Transport vehicles, such as trucks, vans and trailers, are prohibited from travel over public roads or highways until completely aerated to a hydrogen phosphide level at or below 0.1 ppm and the warning placards removed.

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

1. A Fumigation Management Plan must be written for all fumigations prior to actual treatment and must be devised for application, aeration and disposal of the fumigant so as to keep to a minimum any exposures to hydrogen phosphide (refer to Section 10, FUMIGATION MANAGEMENT PLAN).
2. A fumigation zone must be established for all fumigated sites (with the exception of ships and railcars that are in motion) as per the instructions outlined under Section 7, FUMIGATION ZONE REQUIREMENTS.

3. Entry by unprotected workers into the fumigated site is only permitted after the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. For all fumigations, appropriate respiratory protection must be worn if entry into the fumigated site and the fumigation zone is required at any point from the beginning of application until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. Refer to the RESPIRATORY PROTECTION and the APPLICATOR AND WORKER EXPOSURE sections. If entry into the fumigation zone is required at any point from the beginning of application until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.
4. Observe all precautionary and safety statements mentioned elsewhere in this Applicator's Manual.
5. Plates and Strips should be applied so as to provide effective gas concentrations throughout the storage. When this is not possible, exposure times should be lengthened to allow for penetration of gas throughout the treatment area.
6. The site or storage structure to be fumigated must be sealed so as to maintain a suitable gas concentration over the time period required for control of pests.
7. Remove Fumi-Cel Plates and Fumi-Strip entirely from their pouches for application.
8. Do not subdivide Fumi-Cel plates or Fumi-Strip for fumigations.
9. Magnesium phosphide is considerably more reactive than aluminum phosphide, therefore, magnesium phosphide fumigants such as Fumi-Cel plates and Fumi-Strip are the product of choice for treatment under cooler and drier conditions.
10. Piling of Plates, Strips or the addition of liquid to the product is prohibited.
11. Contact with water, acid or other liquids is prohibited. Liquids in contact with unreacted magnesium phosphide will greatly accelerate the production of hydrogen phosphide gas which would result in a toxic and/or fire hazard.
12. Magnesium phosphide fumigants should not be applied to confined spaces where the concentration of hydrogen phosphide may build up to exceed its lower flammable limit.
13. DEGESCH Fumi-Cel plates and Fumi-Strip will corrode certain metals, especially at high concentrations and humidity levels. Protection or removal of wiring, sensitive equipment or precious metals is recommended under these conditions.

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

12.6.2 Fumigation of Mills, Food Processing Plants and Warehouses

1. A Fumigation Management Plan must be written for all fumigations prior to actual treatment (see Section 10).
2. Using the label, calculate the duration of the fumigation and the dosage of Plates or Strips to be applied based upon volume of the building, air and/or commodity temperature and the general tightness of the structure.
3. A fumigation zone must be established as per Section 7, FUMIGATION ZONE REQUIREMENTS.
4. Carefully seal and placard the space to be fumigated and along the fumigation zone perimeter as per Section 10, PLACARDING OF FUMIGATION AREAS.

5. Wear appropriate respiratory protection while handling Fumi-Cel®/Fumi-Strip as per the instructions outlined in Section 6, RESPIRATORY PROTECTION. If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.
6. Apply **FUMI-CEL®** plates and/or **FUMI-STRIP®** to the area to be treated. Lean the Plates against walls, columns, pallet or other support which will allow free access of air to both sides of the Plates. **FUMI-STRIP®** are to be opened, accordion style, and stood on end so that the surfaces of each Plate are exposed.
7. Doors leading to the fumigated space should be closed, sealed, locked and placarded with warning signs.
8. The fumigation period usually lasts from 2 to 5 days depending upon the temperature. Periodically monitor hydrogen phosphide gas levels at several locations along the fumigation zone perimeter (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions). If at any time the person monitoring hydrogen phosphide levels detects hydrogen phosphide concentrations greater than 0.1 ppm, the area MUST immediately be cleared of all individuals who are not wearing respiratory protection as outlined in Section 6, and the fumigation zone must be extended until the hydrogen phosphide levels are at or below 0.1 ppm along the perimeter and warning signs relocated to reflect the new fumigation zone perimeter. Refer to the sections on FUMIGATION ZONE REQUIREMENTS and PLACARDING OF FUMIGATION AREAS for detailed instructions.
9. 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 and the fumigation zone without appropriate respiratory protection until the hydrogen phosphide concentration is at or below 0.1 ppm in the structure. If entry into the fumigation zone is required, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm MUST be worn until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. When required, gas concentration readings may be taken using low level detector tubes or electronic metering devices to ensure safety of personnel who enter the fumigated site and the fumigation zone. Refer to the section on RESPIRATORY PROTECTION and APPLICATOR AND WORKER EXPOSURE.
10. Collect the spent Fumi-Cel® plates and Fumi-Strip for disposal, with or without further deactivation, following directions given under Section 14, DISPOSAL.
11. Remove fumigation warning placards when the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone (see Section 10, PLACARDING OF FUMIGATION AREAS).

12.6.3 **Bunker and Tarpaulin Fumigations**

1. A Fumigation Management Plan must be written for all fumigations prior to actual treatment (see Section 11).
2. A fumigation zone must be established as per Section 7, FUMIGATION ZONE REQUIREMENTS.
3. When possible, conduct tarpaulin fumigations outside. Do not conduct outdoor fumigation of commodities in the proximity of wildlife areas.

Use of plastic sheeting or tarpaulins to cover commodities is one of the easiest and least expensive means for providing relatively gas tight enclosures which are very well suited for fumigation. Poly tarps (4 mil) 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, 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 (4 mil). 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. Use plastic sheeting or tarpaulins of at least 4 mil thickness. Thicker poly sheeting is recommended to reduce the potential for loss of fumigant.

4. Place fumigation warning placards at conspicuous points on the enclosure and along the fumigation zone perimeter as per Section 10, PLACARDING OF FUMIGATION AREAS.

Wear appropriate respiratory protection while handling magnesium phosphide fumigants as per the instructions outlined in Section 6, RESPIRATORY PROTECTION. **FUMI-CEL®** plates or **FUMI-STRIP®** may be applied to the tarped stack or bunker storage of bulk commodity through slits in the poly covering. Avoid application of large numbers of Plates or Strips at any one point.

Do not apply in areas where condensation may occur. The slits in the covering should be carefully taped to prevent loss of gas once the dose has been applied. Plates and Strips are recommended for the treatment of bagged commodities and processed foods where direct contact with spent dust is prohibited or not desired.

Care should be taken to see that the plastic sheeting is not allowed to cover the Plates and Strips 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 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 Fumi-Cel plate will treat a space of from 6.5 to 46 cubic metres. A single Fumi-Strip will treat a volume of from 130 to 925 cubic metres.

5. Periodically monitor hydrogen phosphide gas levels at several locations along the fumigation zone perimeter (i.e., according to a schedule made by the licensed/certified applicator as per site characteristics and environmental conditions). If at any time the person monitoring hydrogen phosphide levels detects hydrogen phosphide concentrations greater than 0.1 ppm, the area must immediately be cleared of all individuals who are not wearing respiratory protection, and the fumigation zone must be extended until the hydrogen phosphide levels are at or below 0.1 ppm along the perimeter and warning signs relocated to reflect the new fumigation zone perimeter. Refer to the sections on FUMIGATION ZONE REQUIREMENTS and PLACARDING OF FUMIGATION AREAS for detailed instructions.
6. Appropriate respiratory protection must be worn if entry into the fumigated site and the fumigation zone is required at any point from the beginning of application until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site. If entry into the fumigation zone is required, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn until the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone. When required, gas concentration readings may be taken using low level detector tubes or electronic metering devices to ensure safety of personnel who enter the fumigated site and the

fumigation zone. Refer to the sections on RESPIRATORY PROTECTION and APPLICATOR AND WORKER EXPOSURE.

7. Remove fumigation warning placards when the fumigated site has been aerated and the hydrogen phosphide level is at or below 0.1 ppm in the fumigated site and the fumigation zone (see Section 10, PLACARDING OF FUMIGATION AREAS).

12.6.4 **Fumigation of Railcars, Containers, Trucks, Vans and Other Transport Vehicles Shipped Piggyback by Rail**

1. A Fumigation Management Plan must be written for all fumigations prior to actual treatment (see Section 11).
2. Railcars and shipping 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.

Transport vehicles, such as trucks, vans and trailers, are prohibited from travel over public roads or highways until completely aerated to a hydrogen phosphide level at or below 0.1 ppm and the warning placards removed.

3. Transport vehicles loaded with bulk commodities to which Plates and Strips may be added directly are treated in essentially the same way as any other flat storage facility. Wear appropriate respiratory protection during application, as per the instructions outlined in Section 6, RESPIRATORY PROTECTION and Section 9, APPLICATOR AND WORKER EXPOSURE. A fumigation zone must be established as per Section 7, FUMIGATION ZONE REQUIREMENTS. During application, post fumigation warning placards around the fumigated site and along the fumigation zone perimeter as per Section 10, PLACARDING OF FUMIGATION AREAS.
4. **FUMI-CEL®** plates may be applied to bulk or bagged materials in railcars by placing them in porous, draw-string bags, one Plate per bag. **Caution: Do not put more than one Plate in a single bag. Do not use bags which will confine the gas.** The porous bags containing the Plates may then be suspended from the hatch cover, from a bulkhead or from a nail in the wall of the railcar. Porous bags containing Plates may be placed in contact with the commodity, after they have been suitably anchored, to take advantage of higher commodity temperatures during periods of cooler weather. The temperature of the commodity is frequently higher than ambient air, particularly in in-transit railcar fumigations conducted during winter months. The higher temperatures may be of considerable benefit in deactivation of the Plates. Cloth bags with draw strings are available from DEGESCH America, Inc., or from Adalia Group, Inc. Carefully seal any vents, cracks or other leaks, particularly if the fumigation is to be carried out in-transit. See Section 10, PLACARDING OF FUMIGATION AREAS 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 Fumi-Cel®/Fumi-Strip has been applied.
5. Written notification must be provided to the receiver of railcars, railroad boxcars, shipping containers and other transport vehicles shipped piggyback by rail 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.
6. During transport, railcars containing non-aerated bulk commodities must not be located directly adjacent to another railcar containing workers or other individuals, unless it is likely to have a serious impact on train dynamics. Railcars containing fumigated cargo should be placed as far as possible from occupied cars.
7. If prolonged/extended stops are required while en route (e.g. to accommodate use of rest facilities or bunkhouses) fumigation zone requirements around the fumigated cargo must be followed (as outlined under Section 7, FUMIGATION ZONE REQUIREMENTS).

8. 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 transport vehicles, a licensed/certified applicator, or a person trained in accordance with the Applicator's Manual working under the direct supervision of a licensed/certified applicator, must perform the aeration process. The applicator must hold an appropriate pesticide applicator certificate or license recognized by the provincial/territorial pesticide regulatory agency where the aeration occurs. Both individuals must be familiar with the properties of hydrogen phosphide fumigants, worker exposure limits, required personal protective equipment and fumigation zone requirements, symptoms and first aid treatment for hydrogen phosphide poisoning, and must know how to take hydrogen phosphide gas concentration measurements. A training completion date must be logged and maintained in the employee's safety training record. Upon receipt of a fumigated commodity, it must be documented in writing that the monitoring has been conducted and that aeration has been completed.

Transfer without aeration:

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

1. Ensure that worker exposure levels are not exceeded by measuring hydrogen phosphide levels in the vicinity of the commodity under fumigation. If hydrogen phosphide levels are above 0.1 ppm, appropriate respiratory protection must be worn (see Section 6, RESPIRATORY PROTECTION). If hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.
2. Ensure that the storage area into which the unaerated railcar, shipping container or transport vehicle shipped piggyback is transferred, is placarded if it contains a hydrogen phosphide level that is above 0.1 ppm or is unknown and conforms to the fumigation zone requirements (refer to Section 7, FUMIGATION ZONE REQUIREMENTS).

Transfer with aeration:

The consignee must:

1. Completely aerate the railcar, shipping containers or other transport vehicles shipped piggyback by rail, containing fumigated commodities while conforming to the requirements outlined under Section 7, FUMIGATION ZONE REQUIREMENTS, and Section 9, PLACARDING OF FUMIGATION AREAS.
2. With the authorization of the licensed/certified applicator, remove the fumigation warning placard after aeration is completed.
3. Ensure that worker safety limits have not been exceeded by verifying that hydrogen phosphide levels are at or below 0.1 ppm.
4. Transfer the fumigated commodity from the railcar, or shipping containers and other transport vehicles shipped piggyback by rail.
5. Dispose of spent fumigant as per Section 15, DISPOSAL.

12.6.5 Fumigation of Ships

12.6.5.1 General Information

1. **IMPORTANT:** Shipboard, in-transit ship or shiphold fumigation is also governed by Transport Canada Ship Safety Regulations (see Cargo, Fumigation and Tackle Regulations under the Canada Shipping Act, current to August 5, 2014). 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. Fumi-Cel® plates and Fumi-Strip are classified as restricted use pesticides due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH₃) gas. These products are for retail sale to and use only by individuals holding an appropriate pesticide applicator certificate or license recognized by the provincial/territorial pesticide regulatory agency where the pesticide application occurs or by workers trained in accordance with the Applicator's Manual and working under the direct supervision and in the physical presence of an applicator holding an appropriate pesticide applicator certificate or license recognized by the provincial/territorial pesticide regulatory agency where the pesticide application occurs. (Physical presence means on site or on the premises). Read and follow the label, Applicator's Manual and Guidance for Preparation of a Fumigation Management Plan which contains complete instructions for the safe use of this pesticide. In facilities where this product is used, all employees must complete mandatory annual training as outlined in the Applicator's Manual – MANDATORY ANNUAL TRAINING. This training includes information on the hazards of this product, the use of safety equipment (i.e., respiratory protection and personal monitors), and the exposure limit of 0.1 ppm. It is the responsibility of the certified/licensed applicator to inform the owner of the facility or his/her representative of the requirements for the mandatory training.

12.6.5.2 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-in-Charge 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 a hydrogen phosphide level at or below 0.1 ppm and a determination has been made by the master of the vessel and the Fumigator-in-Charge that the vessel is safe for occupancy.
2. The Fumigator-in-Charge 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 trained person under the direct supervision of the Fumigator-in-Charge, qualified in the use of this equipment must accompany the vessel with cargo under fumigation. Emergency procedures, cargo ventilation, periodic monitoring and inspections, and first aid measures must be discussed with and understood by the master of the vessel or his/her representative.

*Personal respiratory protection means a NIOSH-approved air-purifying full face respirator (gas mask) with a chin-style, front- or back-mounted canister approved for hydrogen phosphide OR a NIOSH-approved supplied-air respirator (i.e., air-line respirator or self-contained breathing apparatus) with a full face piece for hydrogen phosphide levels up to 5 ppm. A NIOSH-approved self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode OR a NIOSH-approved air-line respirator

with a full face piece operated in a pressure-demand or other positive-pressure mode combined with an auxiliary self-contained positive-pressure breathing apparatus must be worn when hydrogen phosphide levels are above 5 ppm or at unknown concentrations. Refer to Section 6, RESPIRATORY PROTECTION for detailed information.

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 Section 10, PLACARDING OF FUMIGATION AREAS, 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-approved self-contained breathing apparatus (SCBA)* with a full face piece operated in a pressure-demand or other positive-pressure mode and four additional filled air bottles; 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 trained person, under the direct supervision of the Fumigator-in-Charge qualified in their operation. If the fumigated site of the vessel has to be entered before complete aeration, approved respiratory protection must be worn as outlined in Section 6, RESPIRATORY PROTECTION.

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

6. During fumigation, the Fumigator-in-Charge shall ensure that a qualified trained person, under their direct supervision, 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 Fumigator-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 of the ship, 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.

12.6.5.3 **Application Procedures for Bulk Dry Cargo Vessel and Tankers**

1. Fumi-Strip are recommended for the treatment of ship's holds and tanks. Fumi-Cel plates may also be used if they are secured and marked for easy retrieval.
2. Fumi-Strip 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 inserted edgewise into the commodity.

3. Take care to ensure that the Strips are spread out and are applied at least several feet apart. Do not apply Plates or Strips in areas where contact with water is likely.
4. Immediately after application of the fumigant, close and secure all hatch covers, tank tops, butterworth valves, manways, etc.

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

In transit fumigation of containers on ships is also governed by Transport Canada Ship Safety Regulations (see Cargo, Fumigation and Tackle Regulations under the Canada Shipping Act, current to August 5, 2014). 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 11.6.4.

12.6.5.5 **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 sites except under emergency conditions. If necessary to enter a fumigated site, appropriate personal respiratory protection equipment must be used as described in Section 6, RESPIRATORY PROTECTION. Never enter fumigated sites alone. At least two persons, a licensed/certified applicator and trained person, or two persons trained in accordance with the Applicator's Manual working under the direct supervision of the licensed/certified applicator, wearing the required breathing apparatus should enter, and at least one other person, wearing the required personal respiratory protection equipment, should be available to assist in case of an emergency.

12.6.5.6 **Precautions and Procedures During Discharge**

If necessary to enter a fumigated site prior to discharge, test spaces directly above commodity surface for hydrogen phosphide concentration, using appropriate gas detection and personal respiratory protection as described in Section 6, RESPIRATORY PROTECTION. Do not allow entry to fumigated sites without personal respiratory protection, unless hydrogen phosphide concentrations are at or below 0.1 ppm, as indicated by a suitable detector.

13. **MAXIMUM RESIDUE LIMITS FOR FUMIGATED COMMODITIES**

13.1 **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 maximum residue limits for hydrogen phosphide, fumigated commodities must be aerated 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. The licensed/certified applicator is only required to be present until the air concentrations of hydrogen phosphide gas are at or below the exposure limit of 0.1 ppm.

13.2 **Tobacco**

To guarantee compliance with the default maximum residue limit of 0.1 ppm set for hydrogen phosphide in tobacco, fumigated 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 the residue limit of 0.1 ppm. The licensed/certified applicator is only required to be present until the air concentrations of hydrogen phosphide gas are at or below the exposure limit of 0.1 ppm.

14. **STORAGE INSTRUCTIONS**

1. Do not store in buildings where humans or domestic animals reside. This product must be stored away from lodging for humans, animal quarters and normal work areas to avoid inadvertent exposure.
2. Store Fumi-Cel® Plates and Fumi-Strip in a dry, well-ventilated area away from heat, under lock and key. Post appropriate signage indicating it as a pesticide storage area. Do not contaminate water, food or feed by storing pesticides in the same areas used to store these commodities.
3. Keep out of reach of children and prevent access by unauthorized personnel. Do not store in buildings where humans or domestic animals reside.
4. DEGESCH Fumi-Cel Plates and Fumi-Strip are supplied in gas-tight, aluminum foil pouches. These pouches are not re-sealable, and the Plates and Strips must be used immediately or disposed of once they have been opened.
5. The shelf life of Plates and Strips is virtually unlimited as long as the containers are tightly sealed.

15. **DISPOSAL INSTRUCTIONS**

15.1 **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 magnesium phosphide is required to ensure minimal impact on the environment.

Unreacted or partially reacted magnesium phosphide is acutely hazardous and must be deactivated before disposal. If these wastes cannot be disposed of according to label instructions, contact the Provincial Regulatory Agency or the Manufacturer. See also Section 16, SPILL AND LEAK PROCEDURES.

Some local and provincial waste disposal regulations may vary from the following recommendations. Disposal procedures should be reviewed with appropriate authorities to ensure compliance with local and provincial regulations. Contact your Provincial Pesticide Agency.

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

If properly exposed during the fumigation period, Fumi-Cel plates and Fumi-Strip will contain virtually no unreacted magnesium phosphide. This is a non-hazardous waste. However, incompletely exposed Plates and Strips will require special care for disposal

15.2 **Product Container Disposal**

The container must be cleaned prior to disposal. Appropriate respiratory protection (see Section 6, RESPIRATORY PROTECTION) must be worn at all times when levels of hydrogen phosphide are above 0.1 ppm during this process. While monitoring hydrogen phosphide levels or at any other time when hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn. The container should be cleaned in a secured and well-ventilated area or outdoors, away from inhabited buildings to prevent access by unauthorized personnel.

The container must be cleaned prior to disposal. There are two options: 1) Triple rinse empty drums 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 drums 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 by puncturing the container and disposed of in a sanitary landfill, or by other procedures approved by provincial and local authorities.

15.3 Placarding During Deactivation of Unreacted Fumi-Cel/Fumi-Strip

IMPORTANT: Post warning placards on a suitable container used for deactivation (e.g. ventilated basket or similar) and around the fumigation zone perimeter before commencing deactivation. Relocating the placards may be required if the fumigation zone needs to be extended at any point during the deactivation period.

Posting of warning signs for the fumigation zone perimeter is required, UNLESS there is a physical barrier (e.g. fence) that prevents access into the fumigation zone. Signage must not be removed until after deactivation is completed. Only a licensed/certified applicator may authorize removal of warning signs.

Placards must be at least 28 cm long and 21 cm wide and made of substantial material that can be expected to withstand adverse weather conditions. They must bear the following information:

1. The signal word DANGER in letters at least 7 cm high and the SKULL AND CROSSBONES symbol in red.
2. The "DO NOT WALK" symbol.
3. The statement, "Access to area restricted due to deactivation of fumigant chemicals. DO NOT ENTER."
4. The date and start time of the deactivation.
5. Name and registration number of fumigant used: DEGESCH Fumi-Cel®/Fumi-Strip; Registration No. 26188.
6. Contact information (name, address and telephone number) for the supervising fumigant handler in charge of the deactivation.
7. Placards must bear a 24-hour emergency response telephone number..

15.4 Directions for Disposal of Spent Fumi-Cel Plates and Fumi-Strip®

15.4.1 **Do not use these directions for incompletely reacted Fumi-Cel Plates and Fumi-Strips. See Section on Deactivation of Incompletely Reacted Fumi-Cel Plates and Fumi-Strip.**

15.4.2 In open areas, Plates and Strips may be disposed of on site by burial.

15.4.3 Unreacted or improperly exposed Plates and Strips **must** be further deactivated before disposal at a landfill.

15.4.4 Spent Plates and Strips may be collected for disposal in well-ventilated containers such as wire baskets (available from Adalia Group, Inc.) or porous cloth bags of burlap, cotton or other suitable material. The Plates and Strips may be loaded directly into open vehicles for transportation to the disposal site or they may be transported in the ventilated containers used for collection. Do not pile the cloth bags together. Do not use this method for partially spent Fumi-Cels or Fumi-Strips.

15.5 Directions for Deactivation of Incompletely-Reacted Fumi-Cel Plates and Fumi-Strip®

15.5.1 CAUTION: Confinement of partially spent Fumi-Cel plates or Fumi-Strip as in a closed container or plastic bag, may result in a fire hazard. Small amounts of hydrogen phosphide may be given off from unreacted magnesium phosphide, and confinement of the gas may result in a flash.

15.5.2 Ignition may occur if large numbers of incompletely reacted Fumi-Cel plates or Fumi-Strip 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 Adalia Group, Inc.

Partially spent Fumi-Cel plates and Fumi-Strip must be further deactivated prior to transport for ultimate disposal. This is especially true in cases of incomplete exposure or following a fumigation which has produced large quantities of partially spent material.

15.5.3 **Partially spent Plates and Strips may be deactivated as follows using the "Wet Method."**

Appropriate respiratory protection (see Section 6, RESPIRATORY PROTECTION) must be worn at all times when levels of hydrogen phosphide are above 0.1 ppm while handling partially spent Fumi-Cel plates and Fumi-Strip. While monitoring hydrogen phosphide levels during deactivation or at any other time when hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.

A fumigation zone must be established by the licensed/certified applicator around the deactivation site based on their expertise taking into consideration site characteristics and environmental conditions and warning placards must be posted to secure the site and prevent unauthorized persons from tampering with the deactivating dust (see Section 15.3, Placarding During Deactivation of Unreacted Fumi-Cel/Fumi-Strip).

15.5.3.1 Water is used for deactivation of Plates and Strips and other magnesium phosphide fumigants by the "Wet Method". **Detergent solution is not required for magnesium phosphide fumigants.** Fill a drum or other container to be used for wet deactivation with water to within 2 to 5 cm (1 to 2 inches) of the top. Do not allow a large headspace above the surface of the water.

15.5.3.2 Magnesium phosphide will react quite rapidly and very vigorously with liquid water. Therefore, small amount of partially spent material should be tested initially by immersion in water prior to proceeding with large scale wet deactivation. One or two individual Plates or Plates cut off of Fumi-Strip should be evaluated first to determine their level of activity.

15.5.3.3 In a well-ventilated area, out of doors, submerge the entire Plate or Strip in water. The Plates and Strips may float to the surface and, therefore, it is necessary to hold them under water by use of a suitable weight. Caution: Partially spent Plates and Strips may ignite if they are allowed to float to the surface. Active Plates and Strips should be submerged at least 10 to 15 cm to prevent smoking of the liberated hydrogen phosphide gas. Plates and Strips may be placed in wire baskets for immersion in water.

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.

15.5.3.4 Reaction of the magnesium phosphide with water is practically complete within about 15 to 30 minutes. However, Plates and Strips should be totally immersed for at least 6 hours to ensure total hydrolysis.

Caution: Removal of Plates or Strips from water before they are largely deactivated may result in a fire. Completely deactivated Plates and Strips may then be taken to an approved site for disposal. Dispose of the water at a sanitary landfill or other approved site or means. Where permissible, the water may be poured out onto the ground. Do NOT directly pour into a storm sewer.

15.5.4 **Partially Spent Plates and Strips may be Deactivated as Follows Using the "Dry Method"**

Appropriate respiratory protection (see Section 6, RESPIRATORY PROTECTION) must be worn at all times when levels of hydrogen phosphide are above 0.1 ppm while handling partially spent Fumi-Cel plates and Fumi-Strip. While monitoring hydrogen phosphide levels during deactivation or at any other time when hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.

A fumigation zone must be established by the licensed/certified applicator around the deactivation site based on their expertise taking into consideration site characteristics and environmental conditions and warning placards must be posted to secure the site and prevent unauthorized persons from tampering with the deactivating dust (see Section 15.3, Placarding During Deactivation of Unreacted Fumi-Cel/Fumi-Strip).

- 15.5.4.1 Extension of the fumigation period is the simplest method for further deactivation of partially spent Plates and Strips prior to ultimate disposal.
- 15.5.4.2 Alternatively, partially spent materials may be further deactivated by storing the Plates and Strips out of doors, protected from rain and ground water, in locked wire baskets or other similarly ventilated containers. The deactivated Plates and Strips may be taken to an approved site for disposal. Storage of partially spent Plates or Strips in a closed container may result in a fire hazard. Large numbers of partially spent Plates or Strips stored in open containers may ignite if contacted by water.
- 15.5.4.3 Plates and Strips may also be "dry deactivated" by spreading them out onto the ground in a secure, open outdoor area away from inhabited buildings to be deactivated by atmospheric moisture. Care should be taken to ensure that the Plates or Strips are not carried away by the wind. If desired, they may be weighted down by 20 to 30 cm of sand or soil or by other suitable means. Do not use this procedure during periods of rain or if the soil is wet. After complete deactivation, the spent Plates and Strips may be gathered for disposal at approved sites.

Caution: Transport spent Plates and Strips in open vehicles and allow for air circulation between baskets of Plates and Strips.

16. **SPILL AND LEAK PROCEDURES**

16.1 **General Precautions**

A spill, other than incidental to application or normal handling, may produce high levels of hydrogen phosphide gas, and therefore, attending personnel must wear appropriate respiratory protection and personal protective equipment as specified below. Contact the manufacturer and the provincial regulatory agency in case of a spill and for clean-up of spills.

Directions for handling spills and leaks are provided below. Spills and leaks can be of two types:

- 1) spills and leaks in dry, non-wet areas;
- 2) spills into water.

16.2 **Spills and Leaks in Dry, Non-Wet Areas**

Personal Protective Equipment

Appropriate respiratory protection must be worn at all times when levels of hydrogen phosphide gas are above 0.1 ppm while attending to spills and leaks and during deactivation of incompletely reacted Plates and Strips. While monitoring hydrogen phosphide levels or at any other time when hydrogen phosphide levels are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn. Refer to Section 6, RESPIRATORY PROTECTION, and Section 9, APPLICATOR AND WORKER EXPOSURE, for additional details.

Entry by unprotected workers is only permitted after the hydrogen phosphide gas level is at or below 0.1 ppm in the site and the fumigation zone. Refer to Section 6, RESPIRATORY PROTECTION and Section 9, APPLICATOR AND WORKER EXPOSURE for additional details.

Wear a loose fitting long sleeve shirt, long pants, socks and shoes, and wear dry gloves of cotton or other breathable material when handling magnesium phosphide fumigants.

Directions for Handling Spills and Leaks in Dry, Non-Wet Areas

Unless directions specified below under "Deactivation by the Wet Method" are being followed, do not use water at any time to clean up a spill of Fumi-Cel/Fumi-Strip®. Water, acids and other liquids in contact with

magnesium phosphide products will greatly accelerate the production of hydrogen phosphide gas which could result in a toxic and/or fire hazard.

A fumigation zone must be established by the licensed/certified applicator around the location of the spill site based on their expertise taking into consideration site characteristics and environmental conditions. Entry by unprotected workers is only permitted after the hydrogen phosphide gas level is at or below 0.1 ppm in the site and the fumigation zone (Refer to Section 7, FUMIGATION ZONE REQUIREMENTS).

Return all intact magnesium phosphide products to their metal pails or other packaging which has been suitably constructed and marked according to T.D.G.A. regulations. Notify consignee and shipper of damaged cases.

1. If the foil pouches have been punctured or damaged so as to leak, they may be temporarily repaired with aluminum tape. Transport the damaged pouches, thus sealed, to an area suitable for pesticide storage for inspection. **Caution:** The punctured pouches may flash upon opening at some later time. When possible, open pouches outdoors. Do not open in an explosive environment (e.g. flour mill). Further instructions and recommendations may be obtained, if required, from DEGESCH America, Inc. or Adalia Group, Inc.
2. If foil pouches of Fumi-Cel plates or Fumi-Strip have been damaged so severely that they cannot be temporarily repaired, these materials may be wet deactivated on site using the procedure described in Section 15.5.3. Alternatively, spillage may be spread out in an open area away from inhabited buildings to be deactivated by atmospheric moisture. Care should be taken to ensure that the Plates or Strips are not carried away by the wind. If desired, they may be weighted down by 20 to 30 cm of sand or soil or by other suitable means. Do not use this procedure during periods of rain or if the soil is wet. After deactivation, the spent Plates and Strips may be gathered for disposal at approved sites.

16.2.1 **Deactivation of Fumi-Cel/Fumi-Strip® by the Wet Method**

This is similar to the Sec. 15.5.3 (Wet deactivation of partially-spent plates and strips). The differences are that more water is required, and that any water which bubbles out of the drum is replaced.

Caution: Wear appropriate respiratory protection during wet deactivation of unexposed or incompletely exposed magnesium phosphide fumigants. Never place Plates, Strips 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.

Appropriate respiratory protection (see Section 6, RESPIRATORY PROTECTION) must be worn at all times when levels of hydrogen phosphide are above 0.1 ppm while handling magnesium phosphide fumigants or dust and during deactivation of unreacted Plates and Strips. While monitoring hydrogen phosphide levels or at any other time when levels of hydrogen phosphide are unknown, appropriate respiratory protection, OR a personal hydrogen phosphide monitor with a limit of detection of 0.01 ppm and an alarm set at 0.1 ppm must be worn.

A fumigation zone must be established by the licensed/certified applicator around the deactivation site based on their expertise taking into consideration site characteristics and environmental conditions. Warning placards must be posted on a suitable container used for deactivation (e.g. bucket, drum, etc.) and around the fumigation zone perimeter before commencing deactivation in order to secure the site and prevent access by unauthorized personnel (see Section 15.3, Placarding During Deactivation of Unreacted Fumi-Cel/Fumi-Strip). Relocating the placards may be required if the fumigation zone needs to be extended at any point during the deactivation period.

- 16.2.1.1 Water is used for the wet deactivation of FUMI-CEL® plates and FUMI-STRIP® and other magnesium phosphide fumigants. Detergent solution is not required. Fill several drums or other containers to be used for wet deactivation with water to within 2 to 5 cm (1 to 2 inches) of the top. Do not allow a large headspace above the surface of the water. Keep a water supply on hand to top-up drums as necessary. Placards should be posted and the site secured to prevent unauthorized persons from tampering with the

drums.

16.2.1.2 **Magnesium phosphide reacts very vigorously with water and, therefore, only 1 or 2 unexposed Plates should be wet deactivated at one time. Add Plates or Strips to the deactivating solution slowly.** Stir to thoroughly wet all of the product. This procedure should be done in the open air. Plates or Strips should be mixed into no less than 57 litres of water for each case (21 kg) of material to be deactivated. Plates should be cut from **FUMI-STRIP®** rather than attempting deactivation of an entire Strip. Unexposed Plates or Strips will likely ignite if they are allowed to float to the surface of the water. They may be placed into wire baskets or similar containers, weighted and dropped into the water for deactivation. The Plates should be submerged to at least 10 to 15 cm to prevent smoking of the liberated hydrogen phosphide gas. Fill the drum with additional water to eliminate headspace. Do not cover the deactivation vessel at any time.

16.2.1.3 Reaction of magnesium phosphide with water is practically complete within about 15 to 30 minutes. However, the Plates and Strips should be totally immersed for at least 6 hours to ensure total hydrolysis. It is suggested that one or more drums or barrels be set up for the first half hour's immersion, until bubbling has practically ceased, after which the Plates are transferred to a second drum for the remainder of the wet deactivation period.

Caution: Removal of Plates or Strips from water before they are largely deactivated may result in fire. Deactivated Plates and Strips may then be taken to an approved site for disposal.

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

16.3 **Spills into Water**

As releases into water can produce high levels of hydrogen phosphide gas, attending personnel must wear appropriate respiratory protection and personal protective equipment as specified below under EMERGENCY RESPONDER PROTECTION.

IMPORTANT: Emergency responders must be familiar with the "Emergency Response Guidebook", which is maintained by Transport Canada.

WHAT TO DO

In the event of an accidental release, evacuate the area immediately and call for assistance. A response into the spill area should only be attempted by trained emergency responders. As a reference, small and large spills may require isolation distances between 60-500 metres and may also require protective distances between 200 metres and 7.5 kilometres (refer to the "Emergency Response Guidebook").

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 or Adalia Group, Inc. 514-852-3010. For all other chemical emergencies, please contact CHEMTREC – 1-800-424-9300 or Canadian Transport Emergency Centre (CANUTEC) 613-996-6666.

Emergency responders must follow the detailed specifications for magnesium phosphide (ID Number 1397, Guide Number 139) in the "Emergency Response Guidebook", which is maintained by Transport Canada (www.tc.gc.ca/eng/canutec/guide-menu-227.htm).

EMERGENCY RESPONDER PROTECTION

Wear a NIOSH-approved self-contained breathing apparatus (SCBA) with full face piece and operated in a pressure-demand or other positive-pressure mode OR a NIOSH-approved air-line respirator with a full face piece operated in a pressure-demand or other positive-pressure mode combined with an auxiliary self-con-

tained positive-pressure breathing apparatus when the concentration of phosphine gas is unknown. If the concentration is known, other appropriate respiratory protection must be worn as specified in Section 6, RESPIRATORY PROTECTION.

All emergency responses should be made wearing personal protective equipment as specified in Section 5, PROTECTIVE CLOTHING, including chemical-resistant gloves (neoprene, butyl rubber or PVC), a Seranex coated Tyvek suit and rubber boots. Note that the chemical protective clothing listed may provide little or no thermal protection. Structural firefighters' protective clothing provides limited protection in fire situations only; it is not effective in spill situations where direct contact with the chemical is possible.

FOR ASSISTANCE, CONTACT:

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

OR

DEGESCH CANADA, INC.
8685 Rue Lafrenaie
Saint-Léonard, QC
Canada H1P 2B6
Telephone: 514-852-3010

OR

HOT LINE NUMBER

Have the product container label or Applicator's Manual with you when calling a poison control centre, doctor, or when going for treatment. **CONTACT 1-800-308-4856 FOR ASSISTANCE WITH HUMAN OR ANIMAL MEDICAL EMERGENCIES.** You may also contact DEGESCH AMERICA, INC. 540-234-9281/1-800-330-2525 or, DEGESCH CANADA, INC. 514-852-3010. For all other chemical emergencies, please contact CHEMTREC – 1-800-424-9300 or Canadian Transport Emergency Centre (CANUTEC) 613-996-6666.

