SPECIMEN LABEL

ACCEPTED
SEP 30 1994
Under the Federal Insecticide, Fungicide and Rodenticide Act, as amended, for the pesticide registered under EPA Reg. No. 2548-62

HAZARDS TO HUMANS AND DOMESTIC ANIMAL
KEEP OUT OF REACH OF CHILDREN
DANGER/POISON

Aluminum phosphide in tablets or their dust can be fatal if swallowed. Do not get in eyes, in nose, on skin or on clothing. Do not eat, drink or smoke while handling aluminum phosphide fumigants. When the container is opened Detia® Tablets will begin to release hydrogen phosphide (phosphine) which is an extremely toxic gas. Contact with water, acids and some other liquids will accelerate this reaction. If a garlic odor is detected, refer to section on "Industrial Hygiene Monitoring" on page 10 of the accompanying product manual for appropriate monitoring procedures. Pure hydrogen phosphide gas is odorless; the odor is due to a contaminant. Since an odor may not be detected under certain circumstances, the absence of a garlic odor does not mean that hydrogen phosphide gas is absent. Observe proper application, aeration, reentry and disposal procedures specified elsewhere in the labeling to prevent overexposure.

FREQUENT EXPOSURE TO LOW CONCENTRATIONS ABOVE PERMISSIBLE LEVELS OVER A PERIOD OF DAYS OR WEEKS MAY CAUSE POISONING

NOTE TO PHYSICIAN

Aluminum phosphide in tablets or their dust reacts with moisture from the air, water, acids, and many other liquids to release hydrogen phosphide (phosphine) gas. Mild exposure by inhalation causes malaise (indefinite feeling of sickness) ringing of ears, fatigue, nausea and pressure in chest which are relieved by removal to fresh air. Moderate poisoning causes weakness, vomiting, epigastric pain (pain just above the stomach), chest pain, diarrhea and dyspnea (difficulty in breathing). Symptoms of severe poisoning may occur within a few hours or up to several days, resulting in pulmonary edema (fluid in lungs) and may lead to dizziness, cyanosis (blue or purple skin color), unconsciousness and death.

In sufficient quantity, hydrogen phosphide affects the liver, kidneys, lungs, nervous system and circulatory system. Inhalation can cause lung edema (fluid in lungs) and hyperemia (excess of blood in a body part), small permeacular brain hemorrhages and brain edema (fluid in brain). Ingestion can cause lung and brain symptoms, but damage to the viscera (body cavity organs) is more common. Hydrogen phosphide poisoning may result in (1) pulmonary edema, (2) liver elevated serum GOT, LDH and alkaline phosphatase, reduced prothrombin, hemorrhage and jaundice (yellow skin color) and (3) kidney hematuria (blood in urine) and anuria (abnormal or lack of urination). Pathology is characteristic of hypoxia (oxygen deficiency in body tissue). Treatment is symptomatic.

CLASSIFIED BY UNDERWRITERS LABORATORIES INC.® AS TO FIRE HAZARD ONLY WHEN USED SPECIFICALLY AS DIRECTED IN THE SEPARATE INSTRUCTIONS THAT ARE PART OF THE PRODUCT LABELING. DETIA® TABLETS ARE NONCOMBUSTIBLE BUT EXPOSURE TO MOIST AIR OR WATER RELEASES FLAMMABLE AND TOXIC PHOSPHINE GAS. SPONTANEOUS IGNITION MAY RESULT IF CONTACTED BY WATER, ACIDS OR CHEMICALS.®SSP

RESTRICTED USE PESTICIDE
DUE TO ACUTE INHALATION TOXICITY OF HIGHLY TOXIC HYDROGEN PHOSPHIDE (PHOSPHINE, PH3) GAS

For retail sale to and use only by certified applicators for those uses covered by the applicator's certification or persons trained in accordance with the accompanying product manual and working under the direct supervision and in the physical presence of the certified applicator. Physical presence means on site or on the premises. Read and follow the label and the Research Products Company product manual which contains complete instructions for the safe use of this pesticide.

Detia® TABLETS

A fumigant for the control of most stored product insects and their pre-adult stages.

Active Ingredient: Aluminum Phosphide	57 %
Inert Ingredients	43 %
TOTAL	100 %

KEEP OUT OF REACH OF CHILDREN
DANGER/PELIGRO-POISON

PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que la etiqueta se le haya sido explicado ampliamente.

STATEMENT OF PRACTICAL TREATMENT

Symptoms of overexposure to hydrogen phosphide are headache, dizziness, nausea, difficult breathing, vomiting and diarrhea. In all cases of overexposure get medical attention immediately. Take victim to the doctor or emergency treatment facility.

IF GAS OR DUST FROM TABLETS IS INHALED: Get exposed person to fresh air. Keep warm and make sure person can breathe freely. If breathing has stopped, give artificial respiration by mouth to mouth or other means of resuscitation. Do not give anything by mouth to an unconscious person.

IF THE TABLETS OR THEIR DUST ARE SWALLOWED: Drink or administer one or two glasses of water and induce vomiting by touching back of throat with finger, or if available, administer syrup of ipecac. Do not give anything by mouth if victim is unconscious or not alert.

IF TABLETS OR THEIR DUST GET ON SKIN OR CLOTHING: Brush or shake material off clothes. Go shoes in well ventilated area. Allow clothes to aerate in a ventilated area prior to laundering. Do not leave contaminated clothing in occupied and/or confined area such as automobiles, vans, motorrooms, homes, etc. Wash contaminated skin thoroughly with soap and water.

IF DUST FROM THE TABLETS GETS IN EYES: Flush with plenty of water. Get medical attention.

See side panels for additional precautionary statements.

Manufactured for:
Research Products Company
Div. of McShares, Inc.
P.O. Box 1311
Salina, KS 67402-1360

EPA Establishment No. 40345-VA-01
EPA Registration No. 2548-62

Net Contents: 500 Tablets
Net Weight: 1500 grams (3 lbs 4.8 oz.)

DIRECTIONS FOR USE

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

The booklets "Application Procedures for Detia® Pellets and Detia® Tablets" and "Instructions for Intransit Fumigation of Ship Holds with Detia® Pellets and Tablets" are a part of labeling. Refer to them for application procedures and other information necessary to properly use Detia® Tablets.

THIS PRODUCT IS ACCOMPANIED BY THE LABELING LISTED ABOVE. READ AND UNDERSTAND THE ENTIRE LABELING. ALL PARTS OF THE LABELING ARE EQUALLY IMPORTANT FOR SAFE AND EFFECTIVE USE OF THIS PRODUCT. CALL RESEARCH PRODUCTS COMPANY OR EPA IF YOU HAVE ANY QUESTIONS OR DO NOT UNDERSTAND ANY PART OF THIS LABELING.

Refer to product labeling for use restrictions to protect ENDANGERED SPECIES.

STORAGE AND DISPOSAL

STORAGE

Flasks should be stored in a dry, well ventilated area, away from heat and under lock and key. Post as a pesticide storage area. Do not contaminate water, food or feed by storing pesticides in the same areas used to store these commodities.

Do not store in buildings where humans or domestic animals reside. Refer to the booklet "Application Procedures for Detia® Pellets and Detia® Tablets" for additional storage instructions.

DISPOSAL OF UNREACTED OR PARTIALLY REACTED TABLETS (From spills, leaking flasks or other sources)

Unreacted or partially reacted Detia® Tablets are acutely hazardous. Improper disposal of this product is a violation of federal law.

If this product cannot be disposed of by ordinary use or according to label instructions, contact your state pesticide or environmental control agency or the hazardous waste representatives at the nearest EPA regional office for guidance. Do not contaminate water by disposal.

Reacted tablets are not hazardous. For complete disposal spill and leak procedures refer to the booklet "Application Procedures for Detia® Pellets and Detia® Tablets."

DISPOSAL OF EMPTY FLASKS

METHOD ONE: Triple rinse flasks and stoppers with water. Then offer for recycling or reconditioning, or puncture and dispose of them in a sanitary landfill or other approved site or by other procedures approved by state and local authorities. Dispose of rinsate in a sanitary landfill or by other approved procedures.

METHOD TWO: Remove lids and place empty flasks outdoors or in structure being fumigated until residue in flasks is reacted. Puncture and dispose of them in a sanitary landfill or other approved site or by other procedures approved by state and local authorities.

GENERAL

Consult federal, state and local disposal authorities for approved procedures other than those given above. Approved procedures vary for different types of generators.

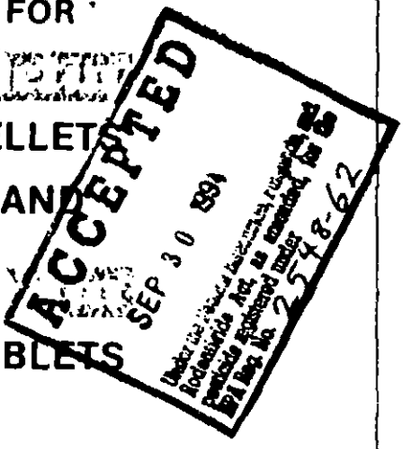
If in doubt, pertaining whether the dust is reacted and for container disposal techniques contact Research Products Company.

R 11/88
P 11/88

PM 31 2548-62 Page 1 of 3

APPLICATION PROCEDURES FOR

PELLETS AND TABLETS



HYDROGEN PHOSPHIDE FUMIGANTS FOR USE AGAINST LISTED INSECTS WHICH INFEST LISTED RAW AGRICULTURAL COMMODITIES, ANIMAL FEEDS, PROCESSED FOODS, NONFOOD PRODUCTS AND STORED TOBACCO

Research Products Company
Div. of McShares, Inc.
P.O. Box 1460
Salina, Kansas 67402-1460

EPA Establishment No. 40285-VA-01
EPA Registration No. 2548-63
EPA Registration No. 2548-62

3 4 13

TABLE OF CONTENTS

I. INTRODUCTION
- A. History
- B. Product Description 2
- C. Product Packaging 2
- D. What is Hydrogen Phosphide? 2
- E. Safety Recommendations 2

II. PRECAUTIONARY STATEMENTS 3
- A. Hazards to Humans and Domestic Animals 3
- B. Statement of Practical Treatment 3
- C. Note to Physician 3
- D. Physical and Chemical Hazards 4

III. DIRECTIONS FOR USE 5
- A. General 5
- B. Efficacy 5
- C. Use Pattern 5
  - 1. Insect Pests 5
  - 2. Commodities 6
- D. Dosage Guide 7
- E. Sealing 8
- F. Exposure Guidelines 8
- G. Application Procedures 9
  - 1. General Statement 9
  - 2. Application Procedures for Direct Addition of Pellets or Tablets to Bulk Commodities 9
  - 3. Application Procedures for Space Fumigations 12
  - 4. Application Procedures for Intransit Fumigation of Ship Holds . . 13
  - 5. Application Procedures for Intransit Fumigation of Containers on Ships 15
  - 6. Application Procedures for Fumigation of Barges . . . 15
  - 7. Application Procedures for Fumigation of Rodent and Mole Burrows 16
  - 8. Application Procedures for Fumigation of Beehives, Supers and Other Beekeeping Equipment 16
- H. Protective Clothing 16
- I. Respiratory Protection 17
- J. Placarding of Fumigated Areas 17
- K. Gas Detection Equipment 18
- L. Aeration of Fumigated Commodities 18
- M. Applicator and Worker Exposure 18
- N. Storage and Disposal 19
- O. Spill and Leak Procedures 20

I. INTRODUCTION

A. HISTORY

The history of Detia™ pesticides is long, dating back to the mid-1930's. In 1970 Detia™ GAS EX B was introduced into the United States. Detia® Tablets and Detia® Pellets were introduced in 1977. Detia Freyberg GMBH West Germany was the early pioneer in the development of hydrogen phosphide as a fumigant gas.

B. PRODUCT DESCRIPTION

Both Detia™ Pellets and Detia® Tablets are in part a mixture of aluminum phosphide (57% by weight) and ammonium carbamate which is pressed into tablet and/or pellet form. The nearly spherical pellets are about 3/8" in diameter and weigh 0.6 grams each. The tablets weigh 3.0 grams each. A pellet will produce about 0.2 gram hydrogen phosphide, the tablet about 1.0 gram. Both react with atmospheric moisture to produce hydrogen phosphide (PH_3) in the following way:

$$AlP + 3\,H_2O \rightarrow Al(OH)_3 + PH_3$$

Warm, humid air accelerates the reaction while cool, dry air has the opposite effect. For example, when moisture and temperature of the fumigated commodity are high, decomposition of Detia® may be complete in less than 3 days. However, at moderate temperatures and low humidities decomposition may require 5 days or more. This reaction starts slowly, gradually accelerates and then tapers off again as the aluminum phosphide is spent.

Detia® Pellets and Tablets contain ammonium carbamate which liberates ammonia and carbon dioxide as follows:

$$NH_2\,COONH_4 \rightarrow 2NH_3 + CO_2$$

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

Spent Detia® is a gray-white powder composed almost entirely of aluminum hydroxide and other approved inert ingredients. If properly exposed, the spent Detia® will normally contain only a small amount of unreacted aluminum phosphide and may be disposed of without hazard. It is NOT considered a hazardous waste. However, the partially spent residue from incompletely exposed Detia® requires special care. Precautions and instructions for further deactivation and disposal will be given later in this manual.

C. PRODUCT PACKAGING

The tablets are packaged 500 to a flask. The pellets are packaged 1660 to a flask.

The aluminum flasks in which they are packaged are resealable and seamless. Their shelf life is almost unlimited as long as the packaging remains well sealed and intact. Once opened, the flasks may be tightly resealed and stored for future use.

D. WHAT IS HYDROGEN PHOSPHIDE?

Hydrogen phosphide, more commonly referred to as phosphine, is a colorless gas which is toxic to insects, humans, and other forms of animal life. It is very mobile with a high vapor pressure. Thus, the penetrating capability of hydrogen phosphide is great. The combination of high molecular activity, vapor pressure and toxicity to insects at low dosages accounts for its wide acceptance as a fumigant.

E. SAFETY RECOMMENDATIONS

1. Carefully read the labeling and follow instructions explicitly.
2. Never work alone when applying fumigant from within the storage structure.
3. Never allow uninstructed persons to handle Detia®.
4. Approved respiratory protection must be available for the fumigation of structures from within.
5. Wear dry gloves made of cotton or other material when contact with tablets, pellets or their dust is likely.
6. It is preferable to open fumigant containers in open air or near a fan that exhausts outside immediately. Never open in a flammable atmosphere.
7. Do not allow Detia® to contact liquid water or to pile up

8. Dispose of empty containers and spent residual dust in a proper manner consistent with the label instructions
9. Post "DANGER" signs on fumigated areas
10. Notify appropriate company employees, and provide relevant safety information to local officials annually for use in the event of an emergency
11. Hydrogen phosphide fumigants are NOT to be used for vacuum fumigations
12. Exposure to hydrogen phosphide must not exceed the 8 hour TWA of 0.3 ppm during application or a maximum concentration of 0.3 ppm after application is completed. This includes reentry into a structure
13. Fumigated finished foods and feeds must be aerated 48 hours prior to offering to the end consumer
14. Transfer of a treated commodity to another site without complete aeration (down to 0.3 ppm maximum) is permissible provided the new site is *placarded*
15. Aerate contaminated clothing in well ventilated area prior to washing
16. Keep containers tightly closed except when removing product
17. Do not reuse aluminum phosphide containers for any purpose other than recycling or reconditioning.
18. OSHA recommends that the exposure screening of employees be conducted to detect impaired pulmonary function. OSHA recommends that any employees developing the above condition be referred for medical attention.

II. PRECAUTIONARY STATEMENTS

A. HAZARDS TO HUMANS AND DOMESTIC ANIMALS
Keep Out of Reach of Children
DANGER-POISON

Aluminum phosphide in Detia® Pellets and Tablets can be fatal if swallowed. Do not get in eyes, in nose, on skin or on clothing. do not eat, drink or smoke while handling aluminum phosphide fumigants. When the container is opened, Detia® Pellets and Tablets will begin to release hydrogen phosphide (phosphine) which is an extremely toxic gas. Contact with water, acids and some other liquids will accelerate this reaction. If a garlic odor is detected refer to the section on "Industrial Hygiene Monitoring" on page 19 for appropriate monitoring procedures. Pure hydrogen phosphide gas is odorless; the odor is due to a contaminant. Since an odor may not be detected under certain circumstances, the absence of a garlic odor does not mean that hydrogen phosphide gas is absent. Observe proper application, aeration, reentry and disposal procedures specified elsewhere in the labeling to prevent overexposure.

FREQUENT EXPOSURE TO CONCENTRATIONS ABOVE PERMISSIBLE LEVELS OVER A PERIOD OF DAYS OR WEEKS MAY CAUSE POISONING

B. STATEMENT OF PRACTICAL TREATMENT
Symptoms of overexposure to hydrogen phosphide are headache, dizziness, nausea, difficult breathing, vomiting and diarrhea. In all cases of overexposure get medical attention immediately. Take victim to a doctor or emergency treatment facility.

1. If gas or dust from tablets or pellets is inhaled: Get exposed person to fresh air. Keep warm and make sure person can breathe freely. If breathing has stopped, give artificial respiration by mouth-to-mouth or other means of resuscitation. Do not give anything by mouth to an unconscious person.
2. If the pellets, tablets or their dust are swallowed: Drink or administer one or two glasses of water and induce vomiting by touching back of throat with finger, or if available, administer syrup of ipecac. Do not give anything by mouth if victim is unconscious or not alert.
3. If pellets, tablets or their dust gets on skin or clothing: Brush or shake material off clothes and shoes in well ventilated area. Allow clothes to aerate in a ventilated area prior to laundering. Do not leave contaminated clothing in occupied and/or confined area such as automobiles, vans, motel rooms, homes, etc. Wash contaminated skin thoroughly with soap and water.
4. If dust from the pellets or tablets gets in eyes: Flush with plenty of water. Get medical attention.

C. NOTE TO PHYSICIAN
Aluminum phosphide tablets, pellets or their dust reacts with moisture from the air, water, acids and many other liquids to release hydrogen phosphide (phosphine) gas. Mild exposure by inhalation causes malaise (indefinite feeling of sickness), ringing of ears, fatigue, nausea and pressure in chest which are relieved by removal to fresh air. Moderate poisoning causes weakness, vomiting, epigastric pain (pain just above the stomach), chest pain, diarrhea and dyspnea (difficulty in breathing). Symptoms of severe poisoning may occur within a few hours to several days resulting in pulmonary edema (fluid in lungs) and may lead to dizziness, cyanosis (blue or purple skin color), unconsciousness and death.

In sufficient quantity hydrogen phosphide affects the liver, kidneys, lungs, nervous system, and circulatory system. Inhalation can cause lung edema (fluid in lungs) and hyperemia (excess of blood in a body part), small perivascular brain hemorrhages and brain edema (fluid in brain). Ingestion can cause lung and brain symptoms but damage to the viscera (body cavity organs) is more common. Hydrogen phosphide poisoning may result in (1) pulmonary edema, (2) liver: elevated serum GOT, LDH and alkaline phosphatase, reduced prothrombin, hemorrhage and jaundice (yellow skin color) and (3) kidney: hematuria (blood in urine) and anuria (abnormal or lack of urination). Pathology is characteristic of hypoxia (oxygen deficiency in body tissue). Frequent exposure over a period of days or weeks may cause poisoning. Treatment is symptomatic.

The following measures are suggested for use by the physician in accordance with his own judgment

1. In its milder to moderate forms (symptoms of poisoning may take up to 24 hours to make their appearance), the following is suggested
   a. Complete rest 1-2 days during which the patient must be kept quiet and warm.
   b. If the patient suffers from vomiting or increased blood sugar, appropriate solutions should be administered. Treatment with oxygen is recommended as is the administration of cardiac and circulatory stimulants.
2. In cases of severe poisoning (intensive care unit recommended)
   a. Where pulmonary edema is observed, steroid therapy should be considered and close medical supervision is recommended. Blood transfusions may be necessary.
   b. In case of manifest pulmonary edema, venesection should be performed under vein pressure control. Heart glycosides (I.V.) can be used in case of hemoconcentration. Venesection may result in shock. In the case of progressive edema of the lungs, immediately intubate and remove edema fluid and administer oxygen over-pressure respiration as well as any measures required for shock treatment. In case of kidney failure, extracorporeal hemodialysis is necessary. There is no specific antidote known for this poisoning.
   c. If pellets or tablets are ingested, induce vomiting. Flush the stomach with a diluted potassium permanganate solution or a solution of magnesium peroxide until flushing liquid ceases to smell of carbide. Thereafter, apply carbomedicinalis.

D. PHYSICAL AND CHEMICAL HAZARDS
Aluminum phosphide in tablets, pellets or partially spent dust will release hydrogen phosphide gas if exposed to moisture from the air or if it comes into contact with water, acids or many other liquids. Piling of tablets, pellets or dust from their fragmentation may cause a temperature increase and confine the release of gas so that ignition could occur.

It is preferable to open flasks of Detia® Tablets or Pellets in open air or near a fan which exhausts outside immediately. Never open in a flammable atmosphere because on rare occasions they may flash. When opening, point the container away from the face and body and slowly loosen the cap. These precautions will also reduce the applicator's exposure to hydrogen phosphide gas.

Pure hydrogen phosphide gas is practically insoluble in water and oils and is stable at normal fumigation temperatures. However, it may react with certain metals and cause corrosion, especially at higher temperatures and relative humidities. Metals such as copper, brass and other copper alloys, and precious metals such as gold and silver are susceptible to corrosion by hydrogen phosphide. 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 electronic or electrical equipment should be protected or removed before fumigation. In most cases all electronic equipment should be removed. Hydrogen phosphide gas will also react with certain metals, salts and therefore sensitive items such as photographic film, some inorganic pigments, etc. should not be exposed.

III. DIRECTIONS FOR USE

A. GENERAL

1. It is a violation of federal law to use this product in a manner inconsistent with its labeling. Detia® Tablets and Pellets are Restricted Use Pesticides due to the acute inhalation toxicity of hydrogen phosphide (phosphine, PH_3) gas. For retail sale to and use only by certified applicators for those uses covered by the applicator's certification or persons trained in accordance with this product manual working under the direct supervision and in the physical presence of the certified applicator. Physical presence means on site or on the premises.
2. Detia® is a highly hazardous material and may be used only by individuals trained in its proper use. Before using, read and follow the label precautions and directions on the label and in labeling.

   Additional copies of this manual are available from:

   Research Products Company
   P.O. Box 1460
   Salina, Kansas 67402-1460
   913-825-2181

3. At least two trained persons must be present when Detia® Pellets or Detia® Tablets are applied from within the space being treated or during reentry into a fumigated or partially aerated site. Only one trained person is required when the fumigant is applied from outside the area to be treated.
4. Prior to applying this product, you must inspect the storage structure to determine if it can be made sufficiently gas tight. Decide how personal exposure monitoring should be conducted. Notify appropriate company employees and provide relevant safety information to local officials annually for use in the event of an emergency. Apply this fumigant in an effective and safe manner including emergency procedures, etc.
5. Ship holds, barges, containers on ships, railroad cars and containers shipped piggyback by rail may be fumigated intransit. However, fumigated trucks, vans, trailers and similar transport vehicles cannot be moved over public roads or highways until they are aerated.
6. Pellets and/or tablets or their reacted residues must not come into contact with any processed food with the EXCEPTION that both can be added directly to processed brewers rice, malt, and corn grits used in the manufacture of beer.
7. Protect copper, silver, gold and their alloys from corrosive exposure to hydrogen phosphide.
8. Do not fumigate commodities with this product when commodity temperature is below 40°F (5°C).

B. EFFICACY

Complete control of listed insect pests is frequently not achieved. Factors contributing to less than 100% control are gas leakage, poor gas distribution, unfavorable exposure conditions, etc. In addition, some insects are less susceptible to hydrogen phosphide than others. To maximize control, extreme care must be observed in sealing, higher dosages must be used, exposure periods must be lengthened, proper application procedures must be followed, and temperature and humidity must be favorable.

C. USE PATTERN

1. INSECT PESTS

Both pellets and tablets are registered with the U.S. Environmental Protection Agency as an aid in the control of the following insects:

almond moth	khapra beetle
angoumois grain moth	lesser grain borer
bean weevil	maize weevil
cadelle	Mediterranean flour moth
cereal leaf beetle	pink bollworm
cigarette beetle	raisin moth
confused flour beetle	red flour beetle
dermestid beetles	rice weevil
dried fruit beetle	rusty grain beetle
dried fruit moth	saw-toothed grain beetle
European grain moth	spider beetles
flat grain beetle	tobacco moth
fruit fly	yellow mealworm
granary weevil	Africanized bee
greater wax moth	[illegible]
hairy fungus beetle	[illegible]
Hessian fly	
Indian meal moth	

2. COMMODITIES

Both Detia® Pellets and Tablets are registered by EPA for the fumigation of the following commodities:

a. Raw Agricultural Commodities

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

b. Processed Foods

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

- Processed candy and sugar
- Cereal flours and bakery mixes
- Cereal foods (including cookies, crackers, macaroni, noodles, pasta, pretzels, snack foods and spaghetti)
- Processed cereal grains (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
- 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)
- Dried and dehydrated vegetables (beans, carrots, lentils, peas, potato flour, potato products and spinach)
- Figs
- Malt
- Peanuts
- Processed herbs, spices, seasonings and condiments
- Processed nuts (almonds, apricot kernels, Brazil nuts, cashews, filberts, pecans, pistachio nuts and walnuts)
- Processed oats (including oatmeal)
- Rice, (brewers rice grits, enriched and polished rice, wild rice)
- Soybean flour and milled fractions
- Processed tea
- Yeast (including primary yeast)

c Animal Feed and Feed Ingredients

d Nonfood Products
Animal hide
Clothing
Processed or unprocessed cotton, wool and other natural fibers or cloth
Feathers
Furs
Human hair, rubberized hair, vulcanized hair, mohair
Leather products
Tobacco
Wood, cut trees, wood chips and wood and bamboo products
Paper and paper products
Dried plants and flowers
Seeds (grass seed, ornamental herbaceous plant seed and vegetable seed)
Straw or hay
Tires (for mosquito control)

D. DOSAGE GUIDE

Since hydrogen phosphide is a mobile gas and will penetrate to all parts of the storage structure, dosage must be based upon the total volume of the space being fumigated and not on the amount of bulk commodity it contains. For example, the same amount of Detia® is required to treat a 30 000 bushel silo whether it is full or not. The following dosage ranges are allowed for bulk and space fumigations.

DOSAGE GUIDE

PRODUCT	PER 1000 CU. FT.	PER 1000 BU STORAGE CAPACITY
PELLETS	100 - 725	125 - 905
TABLETS	20 - 145	25 - 180

These dosages should not be exceeded. It is important to realize that shortened exposure period cannot be compensated for with an increased dosage.

The wide dosage ranges listed above are designed to accommodate the variety of fumigation situations that might occur. The major factor in selecting dosage is the capability of the structure to hold hydrogen phosphide during the exposure period and thus obtain and sustain lethal concentrations throughout. It is more difficult to obtain penetration of gas throughout the structure in bulk stored commodities. An example of this is the treatment of grain stored in flat storage in which fumigant cannot be uniformly added to the grain but must be probed or surface applied.

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 SEVERAL TYPES OF FUMIGATIONS

	TYPE OF FUMIGATION	DOSAGE RANGE		UNIT OF VOLUME*
		PELLETS	TABLETS	
1	SPACE (INCLUDING PACKAGED COMMODITIES)			
	A MILLS, WAREHOUSES, ETC.	100-300	20-60	1000 Cu. Ft.
	B BAGGED COMMODITIES	150-300	30-60	1000 Cu. Ft.
	C DRIED FRUITS, NUTS AND DATES	100-200	20-40	1000 Cu. Ft.
	D STORED TOBACCO	100-200	20-40	1000 Cu. Ft.
2	BULK STORED COMMODITIES			
	A VERTICAL STORAGE	150-330 200-375	30-66 40-75	1000 Cu. Ft. 1000 Bushels
	B FLAT STORAGE	200-350 300-450	40-70 60-90	1000 Cu. Ft. 1000 Bushels
	C BARGES	150-400 200-375	30-80 40-75	1000 Cu. Ft. 1000 Bushels
	H SHIPHOLDS	150-330 200-413	30-66 40-83	1000 Cu. Ft. 1000 Bushels

*volume or storage capacity of the area being treated

The upper dosages listed are recommended in structures that are of loose construction.

E. SEALING

There are many factors affecting a fumigation but most are minor compared to sealing. Proper sealing is necessary to insure effective control of insects and to protect man and other forms of life in adjoining enclosed areas from hydrogen phosphide during the fumigation. Proper sealing must include the closure of all openings except tiny holes or narrow cracks that are very difficult to seal. Maximum results, however, can be achieved if even these are sealed. Polyethylene sheeting and masking or duct tape are adequate sealing materials. Contact Research Products Company for additional information.

F. EXPOSURE GUIDELINES

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

TEMPERATURE TO WHICH FUMIGANT AND/OR INSECTS ARE EXPOSED	PELLETS	TABLETS
Below 40°F	Do Not Fumigate	Do Not Fumigate
40°F - 53°F	8 days(192 hrs.)	10 days(240 hrs.)
54°F - 59°F	4 days (96 hrs.)	5 days(120 hrs.)
60°F - 66°F	3 days (72 hrs.)	4 days (96 hrs.)
Above 68°F	2 days (48 hrs.)	3 days (72 hrs.)

The length of the fumigation must be great enough so as to provide for adequate control of the insect pests which infest the commodity being treated. It is necessary to lengthen the fumigation at lower temperatures since insects are more difficult to kill under these conditions. In this regard, the temperature to which the insects are exposed is the critical factor.

There is little to be gained by extending the exposure period if the structure to be fumigated has not been carefully sealed. Careful sealing is required to ensure that adequate gas levels are retained. Proper application procedures must be followed to provide satisfactory distribution of hydrogen phosphide gas particularly in the fumigation of bulk commodity contained in large storages.

When pellets or tablets are not uniformly added to a bulk commodity mass (i.e. surface application or shallow probing) exposure times must be substantially lengthened to allow penetration of gas throughout the commodity. As a "rule of thumb" a minimum of 1 day should be added to the exposure time listed above for each 10 feet the gas must penetrate downward. It is preferable to add 2 days for each 10 feet. Some structures can only be treated when completely tarped.

In addition, the fumigation period should be long enough that the production of hydrogen phosphide has essentially ceased. This will minimize worker exposure during further storage and/or processing of the treated bulk commodity as well as reduce hazards in the disposal of spent aluminum phosphide products remaining after space fumigations. Temperature and humidity to which Detia® Pellets and Tablets are exposed are important to this determination since both lower temperatures and/or dry air retard gas release.

7 9 13

Consequently exposure periods recommended in the table are minimum periods and may not be adequate to control all stored product pests under all condition. This is particularly true at lower temperatures (below 60°F.) Nor will they always provide for the cessation of the production of hydrogen phosphide when pellets or tablets are exposed to inadequate moisture levels. Grain at 70°F. and 12 percent moisture provides more than adequate conditions for fumigation.

If the temperature to which the insects are exposed is warmer than the temperature to which the pellets or tablets are exposed (as may occur in a winter space fumigation) it may be possible to obtain an effective insect kill before the fumigant is totally spent. In this event it is permissible to conclude a space fumigation as soon as an effective kill has been achieved, however in this event the pellets or tablets must be deactivated prior to disposal. See deactivation instructions on page 21 of this manual.

Whenever possible exposure periods should exceed minimum periods listed on page 8. Remember, the key to effective results lies with correct dosage, long exposure periods, proper application procedures and well sealed enclosures.

G. APPLICATION PROCEDURES

1 GENERAL STATEMENT

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

2 APPLICATION PROCEDURES FOR DIRECT ADDITION OF PELLETS OR TABLETS TO BULK COMMODITIES

a Commodities. Listed raw agricultural commodities, seeds, wood chips, animal feed and feed ingredients, and processed brewers rice, malt and corn grits used in the manufacture of beer.

b Storage Structures. Bins, tanks, silos, granaries, flat storage, bunkers, bulk rail cars, etc.

c Procedures For Vertical Storage. (concrete upright bins and other silo type bins that can be quickly transferred)

(1) For best results all cracks and openings with the exception of fill openings should be closed or sealed prior to fumigating the bin. To this end, vents near the bin top connecting adjacent bins should be sealed prior to the fumigation. If the bin is entered to seal these openings after the fumigant has been added, proper respiratory protection must be worn.

(2) Determine minimum exposure time based on commodity temperature and moisture. At commodity moistures of below 11.5% exposure periods should be extended to obtain complete reaction of the fumigant.

(3) Calculate the number of pellets or tablets needed and the rate at which they must be added based upon the rate at which the bin will be filled.

(4) Pellets or tablets may be applied by hand or by an automatic dispenser on the headhouse/gallery belt or into the fill opening. An automatic dispenser may also be used to add fumigant into the upleg of the elevator. Add fumigant in as continuous a manner as possible to the commodity stream.

(5) Seal the bin deck openings after the application is complete.

(6) Vertical bins can be fumigated by deep probing.

(7) Bins requiring more than 24 hours to fill should not be fumigated by direct addition as the bin is filled. These bins must be fumigated by probing, surface application, or other appropriate methods.

(8) Post "DANGER" placards on all entrances and on the discharge gate.

(9) Bins needn't be aerated until they are transferred. Workers must not be over exposed during this transfer.

d Procedures For Flat Storage. (rectangular shaped bins, tanks, farm style bins and other horizontal bins)

(1) Check the storage for tightness.

(2) To the extent practical, seal any vents, cracks or other sources of leaks.

(3) Determine application procedure to be used. This can include shallow probing, deep probing, uniform addition as the bin is filled, or surface application.

Bins requiring more than 24 hours to fill should not be fumigated by addition as the bin is filled since large quantities of gaseous fumigant may escape before the bin is finally sealed.

Probes should be inserted at horizontal intervals along the length and width of the bin. The number of pellets or tablets per probe is determined by dividing the total number of pellets or tablets by the total number of probings. Pellets or tablets will be dropped in to the probes at intervals as the probe is withdrawn. Releasing all the fumigant into the probe at once may retard the production of hydrogen phosphide and might cause an ignition of gas trapped in the clump of pellets or tablets.

Surface application can be used if the bin can be made sufficiently gas tight to contain the fumigant long enough for it to penetrate throughout. In this instance it is advisable to place 1/4 of the dosage in the floor level aeration ducts. This fumigant must not contact liquid phase water.

(4) Determine dosage and exposure time. The dosage will depend in large part on a combination of the tightness of the seal, the application procedure and the grain depth. The poorer the seal and the farther the gas must penetrate to reach throughout the bin the higher the required dosage will be. For good results add the length of time required for the gas to penetrate throughout the bin to the exposure time given on page 8 of this manual. To the extent possible, lengthen the exposure period. As a "rule of thumb" a minimum of 1 day should be added to the exposure time for each 10 feet the gas must penetrate downward. It is preferable to add 2 days for each 10 feet.

Exposure periods listed on page 8 of this manual should also be lengthened at commodity moistures below 11.5% to obtain complete reaction of the fumigant.

(5) Arrange enough applicators and other workers to complete the job quickly enough to avoid excessive exposure to hydrogen phosphide gas. The production of gas during application can be significantly retarded by venting flasks outdoors, conducting fumigations when temperatures in the bin are lowest, and other work practices. It is often advisable to wear approved respiratory protection from start to finish. Monitoring with a suitable detection device is required to assure that the 0.3 ppm 8 hour TWA is not exceeded. See "Industrial Hygiene Monitoring" section on page 19 of this manual.

(6) It is often advisable as an additional sealing measure to cover the commodity with plastic tarps.

(7) Seal all remaining exits.

(8) Post "DANGER" placards on and lock all entrances.

(9) The bin needn't be aerated unless reentry is required. Consult safety procedures listed elsewhere in labeling.

e Procedures for Bunkers and Other Outdoor Tarped Commodities

(1) See steps "3" and "4" in section "c" above.

(2) When tarps are being spread over ground storage they should be glued, clamped or otherwise sealed together. Sand or water snakes can be used for a ground seal.

(3) Application may be made through slits in the tarp or the tarp can be spread over the commodity after application. Seal slits after application.

(4) Post "DANGER" placards.

(5) This is an outdoor application so safety monitoring and respiratory equipment are not required.

f Procedures for Rail Cars, Containers, Trucks, and other Transport Vehicles

Rail cars, containers, trucks and other transport vehicles loaded with bulk commodities to which Detia® Tablets or Pellets may be added are treated in essentially the same way as any other storage facility. Detia® may be added as the vehicle is being filled, the dose may be scattered over the surface after loading has been completed or the tablets or pellets may be probed below the surface. Carefully seal any vents, cracks or other leaks particularly if the fumigation is to be car-

ried out intransit. Remember, rail cars, and containers shipped pig gyback by rail may be fumigated intransit, but it is not legal to move trucks, trailers etc. over public roads or highways until they are aerated. See section "III. J." on page 17 of this manual for recommendations on placarding, commodity aeration and training of persons authorized to remove placarding.

Notify the consignee if the commodity is to be shipped under fumigation. If the consignee is unfamiliar with proper handling of fumigated rail cars, it is recommended that they be provided with the necessary information.

g. Procedures for Farm Storage

(1) General

Since on farm storage is almost always flat storage, refer to "Procedures for Flat Storage" on page of 9 this manual. The instructions which follow provide additional guidance.

(2) Sealing

Leakage is the single most important cause of failure in the treatment of farm bins. Since these bins are usually small by comparison they have a higher leakage area in proportion to their capacity. Most wooden granaries are so porous that they cannot be successfully fumigated unless they are completely covered with plastic sheeting or similar tarp. Steel bins are also usually of very loose construction and therefore, require much attention to sealing. All vents and aeration ducts must be tightly sealed using 4 mil polyethylene sheeting or its equivalent. The plastic must be sealed directly to the metal with tape or other adhesive. It is not sufficient to "cinch up" the plastic as with a belt. The surface of the grain should be covered with plastic sheeting after Delta* has been applied. Tarping of the grain surface will greatly reduce leakage. Other sealing techniques are recommended, i.e. closure of all large cracks with caulking, foam insulation or other sealant. Sealing these cracks will greatly reduce the required dosage. Two mil or thicker plastic can be used for tarping the grain surface, however, the plastic used on the outside of the bin should be at least 4 mils. When an entire structure is tarped the plastic must be at least 6 mils thick to prevent excessive tearing during the fumigation.

(3) Dosage

Unless all the large cracks are sealed as described above the dosage recommended should be 90-180 tablets or 450-900 pellets per 1000 bu. capacity of the space under the plastic tarp.

(4) Additional Application Instructions

Probing tablets or pellets into the grain mass is the recommended method of application. Probe insertions should be scattered evenly over the surface. A rigid PVC pipe, about 5 to 7 feet long and 1 1/4 inch diameter can be used. In this event use about 20-50 tablets or 100-250 pellets per probe. The fumigant is gradually released into the probe as it is withdrawn from the grain. Releasing all the fumigant into the probe at once may retard the production of hydrogen phosphide and might cause an ignition of gas trapped in the clump of pellets or tablets. Place no more than 1/4 of the total dose in floor level aeration ducts. Be sure the inside of the aeration duct is dry before adding the pellets or tablets. Addition of Delta* to water in an aeration duct can cause a fire. Seal the aeration fan as described above.

(5) Additional Precautions

Do not fumigate bins that will be entered by humans or animals prior to aeration. Do not fumigate areas which house equipment containing copper or other metals which will be corroded by hydrogen phosphide. This includes electrical and electronic equipment.

Place "DANGER" placards on entrances to the bin and near the ladder. See section on "PLACARDING OF FUMIGATED AREAS" on page 17 of this manual.

If monitoring equipment is not available, an approved canister respirator must be worn for indoor application. If an approved respirator is not available, application must be done from outside of the site to be fumigated. Also refer to all other precautions given in this manual.

(6) Post Aeration Treatment

It is good practice to spray the grain surface with an approved insecticide protectant to retard reinfestation and to fog the space above the grain to kill existing adult flying insects.

3. APPLICATION PROCEDURES FOR SPACE FUMIGATIONS

a. Procedures for Mills, Warehouses, Food Processing Plants, Chambers, Trucks, Trailers, Containers and other Static Sealable Enclosures

(1) Determine the dosage of tablets or pellets to be applied based upon the following parameters for space fumigation:

The volume of the structure
The air and/or commodity temperature
The general tightness of the structure to be fumigated

(2) Determine exposure period based on the "Exposure Guide" on page 8 of this manual.

(3) Seal all openings except for the door being used to enter and leave. Pay particular attention to openings to connecting or adjacent structures.

(4) Place trays or sheets of Kraft paper or foil up to 12 sq. ft. (1.1 sq. m) in area, on the floor throughout the structure to hold Delta* Tablets or Pellets.

(5) Spread Delta* on the sheets at a density no greater than 30 tablets per sq. ft. or 75 pellets per sq. ft. This corresponds to slightly more than one half flask of tablets or one half flask of pellets per 3' x 4' sheet. Check to see that they have not piled up and that they are spread out evenly to minimize contact between the individual tablets or pellets.

(6) Pellets and tablets may also be applied in moisture permeable envelopes to fumigate commodities. When fumigating in this way the envelopes must be fastened to a substantial support. Place no more than 10 pellets nor more than 2 tablets into one envelope. Delta* Pellets and Tablets shall not be placed in or attached to commodity packages intended for retailers.

(7) When fumigating multiple story buildings, each floor is considered a separate enclosure. Application should begin with the top floor and end with the ground floor.

(8) Seal all remaining exits.

(9) Placard and lock all entrances.

(10) Aerate the structure upon completion of the exposure period. Standard aeration time and practices should be developed using a low level detection device. Practices will vary widely at different sites but will usually include opening windows, doors and vents and activating any ventilation equipment. Reentry of an unaerated structure must be done in pairs wearing appropriate respiratory equipment.

(11) Dispose of remaining dust from tablets or pellets. SEE "STORAGE AND DISPOSAL" on page 19 of this manual. Avoid breathing the dust.

b. Procedures for Space Fumigations Under Tarps

(1) General

Follow the pertinent instructions given immediately above in part a.

Use of plastic sheeting or tarpaulins to provide a fumigation enclosure is one of the easiest and least expensive means for providing relatively gas tight enclosures which are very well suited for fumigation. Plastic tarps are penetrated only very slowly by hydrogen phosphide gas, and tight coverings are readily formed from the sheets. The volume of these enclosures may vary widely.

(2) Sealing

An enclosure suitable for fumigation may be formed by covering packaged commodities with plastic sheeting. The sheets may be taped, glued, or clamped 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 plastic sheeting prior to covering for fumigation. The plastic covering of the pile may be sealed to the floor using tape, glue, sand or water snakes, by

shoveling soil or sand onto the ends of the plastic covering or by other suitable procedures. The plastic covering should be reinforced by tape or other means around any sharp corners or edges in the stack so as to reduce the risk of tearing. Thinner sheeting about 2 mils is suitable for most indoor tarp fumigations. However 4 mil plastic or thicker is more suitable for outdoor applications where wind or other mechanical stresses are likely to be encountered.

(3) Additional Application Instructions.
Tablets or pellets may be applied under the edge of the tarp or through slits. The pellets or tablets should be protected from condensation or other source of water. The slits in the covering should be carefully taped to prevent loss of gas once the dose has been applied. Pellets or tablets must be placed in a single layer. Care should be taken to prevent the plastic tarp from covering the pellets or tablets in such a way as to prevent contact with moist air or to confine the gas. Refer to other sections for dosage and exposure times.

(4) Additional Precautions.
See appropriate precautions if the fumigation is conducted indoors as opposed to outdoors. Indoor fumigation precautions are handled as any other situation where the application is made from outside the area being fumigated (i. e. the adding of pellets or tablets to a dispenser for uniform addition to grain). Workers may occupy adjacent indoor areas but they must be protected from overexposure to hydrogen phosphide by adequate sealing, ventilation or as a last resort, respiratory equipment.

Do not walk on stacks during the fumigation.

Place "DANGER" placards at conspicuous points on the enclosure.

Follow precautions listed elsewhere in labeling.

(5) Aeration
Precautions must be taken to assure that exposure to hydrogen phosphide in excess of allowed limits does not occur both during the fumigation and aeration.

4. APPLICATION PROCEDURES FOR INTRANSIT FUMIGATION OF SHIP HOLDS

a General Information
(1) Shipboard fumigation is also regulated by the U. S. Coast Guard Regulations 46 CFR 147A.
(2) This product is toxic to fish. Keep out of lakes, streams and other aquatic environments. Do not contaminate water by cleaning equipment or disposal of wastes.

b Pre-Voyage Fumigation Procedures and Precautions
(1) Refer to and comply with the regulations and procedures found in U. S. Coast Guard Regulation, 46 CFR 147A.
(2) Prior to fumigating a vessel for intransit cargo fumigation, the master of the vessel or his representative, and the fumigator must determine whether the vessel is suitably designed and configured so as to allow for safe occupancy by the ship's crew throughout the duration of the vessel and the fumigation/voyage.

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/voyage, then the vessel will not be fumigated unless all crew members are removed from the vessel. The crew members will not be allowed to re-occupy the vessel until the vessel has been properly aerated and a determination has been made by the master of the vessel and the fumigator that the vessel is safe for occupancy.
(3) The person responsible for the fumigation must notify the master of the vessel, or his representative of the requirements relating to personal protection equipment*, low range detection equipment and that a person qualified in the use of this equipment must accompany the vessel with cargo under fumigation. Emergency procedures, cargo ventilation, periodic monitoring and inspections, and first aid measures must be discussed with and understood by the master of the vessel or his representative.
(4) Seal all openings to the cargo hold or tank using suitable water proof, gas tight materials. Lock and/or otherwise secure all openings, manways, etc. used to enter the hold. Post appropriate "DANGER" placards on same.

(5) On tankers the over space pressure relief system of each tank must be sealed by (1) the closing of appropriate valves and (2) sealing the openings into the over space with gas tight material.
(6) Contact appropriate authorities.
(7) If the fumigation is not completed and the vessel aerated before the manned vessel leaves port. The person in charge of the vessel shall insure that at least two units of personal protection equipment and one gas or vapor detection device and a person qualified in their operation be on board the vessel during the voyage.
(8) During the fumigation or until a manned vessel leaves port or the cargo is aerated. The person in charge of the fumigation shall insure that a qualified person using gas or vapor detection equipment test spaces adjacent to the fumigated cargo area and all regularly occupied spaces for fumigant leakage.

If leakage of the fumigant is detected, the person in charge of the fumigation shall take action to correct the leakage or shall inform the master of the vessel or his representative of the leakage so that corrective action can be taken.
(9) Review with the master, or his representative, the voyage precautions and procedures.

*Personal protection equipment means a respirator or gas mask fitted with a canister designed for phosphine gas which is approved by NIOSH/MSHA. A gas mask and canister is approved for use up to 15 ppm. Above 15 ppm or at unknown concentrations a SCBA or its equivalent must be used.

c Procedures for Bulk Dry Cargo Vessels and Tankers
(1) Apply either the tablets or pellets by scattering them uniformly onto the commodity surface utilizing as much of the total surface area as possible or insert them uniformly into the commodity mass by hand or with probes to any depth desired.
(2) Close and secure hatch covers, tank tops, butterworths, etc. immediately following application.

d Voyage Precautions and Procedures
(1) At regular intervals monitor spaces adjacent to areas containing fumigated cargo and all regularly occupied areas for fumigant leakage using appropriate gas detection equipment.

Special attention should be given to living quarters, kitchens, storerooms, mess halls, keel ducts, day rooms, the bridge, engine room and any other enclosed spaces occupied or frequented by crew members during a voyage.
(2) If hydrogen phosphide is detected, evacuate the space or area, locate and seal off the source of the leak wearing appropriate respiratory protection equipment. Ventilate the area before allowing occupants to return.
(3) Do not enter fumigated holds or tanks.
(4) Do not open, ventilate or aerate the fumigated holds during the voyage.

e Precautions and Procedures During Discharge
If necessary to enter holds prior to discharge, test spaces directly above cargo surface for fumigant concentration, using appropriate gas detection and personal protection equipment. Do not allow entry to fumigated areas without personal protection equipment unless fumigant concentrations are at safe levels as indicated by a suitable detector.

f Personal Protective Equipment and Monitoring
(1) Fully loaded holds on dry bulk carriers are considered an outdoor fumigation.
(2) Tanker holds which must be entered to fumigate and partially loaded holds on dry bulk carriers are fumigated from within the area being treated.
(3) See sections I and M on pages 17, 18, and 19 of this manual for requirements.
(4) If hydrogen phosphide is detected a minumum of two qualified persons on ship should wear the gas mask and canister described above while aerating the area and locating and sealing the leak.

5 APPLICATION PROCEDURES FOR INTRANSIT FUMIGATION OF CONTAINERS ON SHIPS

a. When fumigating bulk commodities to which direct addition of pellets or tablets is not allowed or packaged commodities refer to section "3 a" on page 12 of this manual Do not place tablets loosely on trays or sheets of paper or foil since movement of the container may disrupt the correct placement of pellets or tablets Instead they must be applied in moisture permeable envelopes as described in section "3.a (6)"

b When fumigating a commodity by direct addition of pellets or tablets refer to Section "2 1 " on page 10 of this manual

c Intransit fumigation of containers on ships is regulated by Coast Guard Regulation 46 CFR 147A and the applicator or shipper must obtain and comply with U.S. Coast Guard Special Permit No 52-75 Contact the Coast Guard or Research Products Company for additional information.

d. Comply with general precautions given in labeling

6. APPLICATION PROCEDURES FOR FUMIGATION OF BARGES

a. General

Since barge fumigation is a type of flat storage fumigation as well as having similarities in common with a ship, refer to the sections "Procedures for Flat Storge" on page 9 and "APPLICATION PROCEDURES FOR INTRANSIT FUMIGATION OF SHIP HOLDS" on page 13.

Barge fumigation is regulated by the U S. Coast Guard Regulations 46 CFR 147A as modified by U S Coast Guard Special Permit 2-75 The shipper or fumigator must possess this permit prior to fumigating To obtain this permit contact

U S Coast Guard
Hazardous Materials Branch
Washington, D C. 20593-0001

b Sealing

Special care must be taken in determining whether a barge is suitable for fumigation. Excessive leakage may occur through poorly sealed hold covers

7. APPLICATION PROCEDURES FOR FUMIGATION OF RODENT AND MOLE BURROWS

a. List of Burrowing Pests

Detia® Tablets and Pellets may be used out of doors only for the control of the following burrowing rodents and moles marmot sp -woodchucks and yellow-belly marmots (rockchucks), prairie dogs (except Utah prairie dog), Norway and roof rats, mice, ground squirrels, moles (except in Indiana), voles, gophers and chipmunks (except in California)

b. Application Instructions

Add from 1 to 4 Detia® Tablets or 5 to 20 Detia® Pellets to each burrow opening. Seal tightly by shoveling soil over the entrance Place the pellets or tablets far enough down the burrow that the soil used to plug the burrow doesn't cover the pellets or tablets, slowing down their action. Where possible, subsurface tunnels or runways should be treated every 5 to 10 feet with a dose of 2 to 4 tablets or 10 to 20 pellets. Use lower rates in smaller burrows, in tight soils, under moist soil conditions and higher rates in larger burrows, in porous soils and/or when soil moisture is low. In extremely dry or porous soil, it is sometimes not possible to obtain satisfactory results This is particularly true in instances where the burrow s,stems are extensive such as moles or gophers. It is always better not to fumigate during extended periods of dry weather. Treat reopened burrows and fresh runways a second time 1 to 3 days after the initial treatment

Detia® may be used out of doors only, for control of burrowing pests. Do not use within 15 feet (5 meters) of inhabited structures. Do not apply to burrows which may open under or into occupied buildings.

c. Environmental Hazards

This product is highly toxic to wildlife. Non-target organisms exposed to hydrogen phosphide gas in burrows will be killed Do not apply

directly to water or wetlands (swamps bogs marshes and potholes) Do not contaminate water by cleaning of equipment or disposal of wastes

d Endangered Species Restrictions

The use of Detia® in a manner that may kill or otherwise harm an endangered or threatened species or adversely modify their habitat is a violation of federal law. The use of this product is controlled to prevent death or harm to endangered or threatened species that occur in the following counties or elsewhere in their range Use of this product in the areas listed below is prohibited without first contacting and obtaining permission from the Endangered Species Specialist at the nearest regional offices of the U S Fish and Wildlife Service (FWS)

Areas Inhabited by Endangered or Threatened Species

(1) Black footed ferret - States of Arizona, Colorado, Kansas, Montana Nebraska, New Mexico North Dakota, Oklahoma, South Dakota, Texas Utah and Wyoming
(2) Blunt-nosed leopard lizard - Counties of Kern, Kings, Fresno, Madera, Merced, and Tulare in the state of California.
(3) Desert tortoise - Washington county in the state of Utah.
(4) Eastern indigo snake - States of Florida and Georgia
(5) San Joaquin kit fox - Counties of Kern, Kings, Fresno, Merced, Monterey, San Benito, San Luis Obispo, Santa Barbara, Tulare and Ventura in the state of California

e Special Local Restrictions

(1) NORTH CAROLINA
Detia® Tablets and Pellets may only be used for control of rats and mice in the state of North Carolina Use against other pests is not permitted
(2) OKLAHOMA
A special permit for black-tailed prairie dog control by poisoning is required in Oklahoma Contact the Oklahoma State Department of Wildlife Conservation to obtain this permit
(3) WISCONSIN
A state permit is required for use of pesticides in Wisconsin to control small mammals, except rats or mice Please contact your local Department of Natural Resources office for information
(4) INDIANA
Use of Detia® Tablets or Pellets for mole control is not legal in the state of Indiana
(5) MISSOURI
A state permit is required for use of pesticides in Missouri to control small mammals, except rats and mice Please contact the Missouri Department of Conservation office for information
(6) KANSAS
A special permit for black-tailed prairie dog control by poisoning is required in Kansas Contact the Kansas Fish and Game Commission to obtain this permit
(7) CALIFORNIA
Use of Detia® Tablets and Pellets for chipmunk control is not legal in the state of California

8 APPLICATION PROCEDURES FOR FUMIGATION OF BEEHIVES, SUPERS AND OTHER BEEKEEPING EQUIPMENT

Detia® Tablets and Pellets may be used for the control of the greater wax moth in stored beehives supers and other beekeeping equipment and for the destruction of bees, Africanized bees and diseased bees including those infested with tracheal mites and foulbrood The recommended dosage for this use is 30-45 tablets or 150-225 pellets per 1000 cu ft

Fumigations may be performed in chambers at atmospheric pressure, under tarpaulins, etc , by placing the tablets or pellets on trays or in moisture permeable envelopes Do not add more than 2 tablets or 10 pellets to each envelope Honey from treated hives or supers may only be used for bee food

H. PROTECTIVE CLOTHING

Wear dry gloves made of cotton or other material if contact with tablets, pellets or their dust is likely Wash hands after use

I. RESPIRATORY PROTECTION

1 WHEN RESPIRATORY PROTECTION MUST BE WORN
NIOSH/MSHA approved respiratory protection must be worn during exposure to concentrations in excess of permitted limits or when concentrations are unknown

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

3. REQUIREMENTS FOR AVAILABILITY OF RESPIRATIORY PROTECTION
Respiratory protection must be available at the site of application in case it is needed when applying Detia* from within the structure being fumigated. An approved full face gas mask - phosphine canister combination or self-contained breathing apparatus (SCBA) or its equivalent must be available at the site of application. If SCBA or its equivalent is not available at the application site, it must be available locally, for example, at a fire station or rescue squad.

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

Respiratory protection need not be available for outdoor applications.

If monitoring equipment is not available on a farm and application cannot be done from outside the structure, an approved canister respirator must be worn during application from within the enclosed indoor area.

J. PLACARDING OF FUMIGATED AREAS

The applicator must placard or post all entrances to the fumigated area with signs bearing:

1 The signal word "DANGER/PELIGRO" and the SKULL and CROSSBONES *symbol in red*
2. The statement, "Area and/or commodity under fumigation. DO NOT ENTER/NO ENTRE".
3 The statement "This sign may only be removed after the commodity is completely aerated (contains 0.3 ppm or less phosphine gas). If incompletely aerated commodity is transferred to a new site, the new site must also be placarded and workers must not be exposed to more than 0.3 ppm phosphine."
4. The date and time fumigation begins and is completed
5 Name of fumigant used
6 Name, address, telephone number of the applicator

All entrances to a fumigated area must be placarded. Where possible placards should be placed in advance of the fumigation in order to keep unauthorized persons away. For railroad hopper cars placarding must be placed securely on both sides of the car near the ladders and next to the top hatch into which the fumigant is introduced.

Do not remove a placard until the treated commodity is aerated down to 0.3 ppm or less. To determine whether aeration is complete, each fumigated site or vehicle must be monitored and shown to contain 0.3 ppm or less hydrogen phosphide gas in the air space around and, when feasible, in the mass of commodity.

Transfer of incompletely aerated commodity to a new site is permissible however, the new storage must be placarded if it contains more than 0.3 ppm hydrogen phosphide.

Workers who handle incompletely aerated commodity must be informed and apropriate measures must be taken (i.e., ventilation or respiratory protection) to prevent exposures from exceeding the exposure limits for hydrogen phosphide.

11 9 '3

It is recommended that the persons responsible for fumigating be familiar with the physical, chemical and toxicological properties of hydrogen phosphide. They should also be knowledgeable in how to take gas readings, exposure limits, symptoms and first aid treatment for hydrogen phosphide poisoning.

K. GAS DETECTION EQUIPMENT

There are several reliable devices marketed. One type is the hand pump aspirator used in conjunction with the appropriate detector tube. They are portable, simple devices and do not require intensive training or elaborate supporting equipment to operate. Furthermore, they are inexpensively adaptable to remote monitoring procedures and will measure concentrations of hydrogen phosphide in air in trace amounts on up. Use instructions are enclosed with each purchase. Consult your local supplier of such equipment or contact Research Products Company for more information.

L. AERATION OF FUMIGATED COMMODITIES

1 *FOODS AND FEEDS*
Tolerances for hydrogen phosphide residues have been established at 0.1 ppm for animal feeds and 0.01 ppm for finished foods. To guarantee compliance with these tolerances, it is necessary to aerate these commodities for 48 hours prior to offering them to the end consumer.

2 TOBACCO
Tobacco must be aerated for at least three days (72 hours) when fumigated in hogsheads and for at least two days (48 hours) when fumigated in other containers. When plastic liners are used longer aeration periods will probably be required to aerate the commodity down to 0.3 ppm.

3 As an alternative to these aeration periods each container of a treated commodity may be analyzed for residues using accepted analytical methods. If residues are less than tolerance levels the commodity may be shipped to the consumer regardless of the above holding periods.

M. APPLICATOR AND WORKER EXPOSURE

1 HYDROGEN PHOSPHIDE EXPOSURE LIMITS
Exposure to hydrogen phosphide must not exceed the 8 hour TWA of 0.3 ppm for applicators and workers during application. Application is defined as the time period covering the opening of the first container and giving the appropriate dosage of fumigant and closing up the site to be fumigated. All persons in the treated site and in adjacent indoor areas are covered by this exposure standard.

After application is completed worker or applicator exposure must not exceed 0.3 ppm maximum concentration. Such exposures may occur because of leakage into enclosed areas from fumigation sites during reentry or during transfer of unaerated commodity.

2 APPLICATION OF FUMIGANT
Depending upon temperature and humidity Detia Tablets and Pellets release hydrogen phosphide gas slowly upon exposure to moisture from the air. This release is often slow enough to permit applicators to deposit fumigant in the desired areas and then vacate the premises without significant exposure to the gas. If the fumigator's exposure exceeds the 8 hour TWA of 0.3 ppm, approved respiratory protection must be worn. Gas concentration measurements for safety purposes must be made using low level detector tubes or other suitable low level detection equipment. See the "Industrial Hygiene Monitoring" section below. Information on hydrogen phosphide (phosphine PH_3) detector tubes may be obtained from Research Products Company.

It is often practical to wear approved respiratory protection from start to finish. This is particularly true when performing large space fumigations or when fumigating bulk stored commodities in flat storage buildings.

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

4 AERATION AND REENTRY
If the area is to be entered after fumigation it must be aerated until the level of hydrogen phosphide gas is 0.3 ppm or below. The area or site must be monitored to ensure that liberation of gas from the treated commodity does not result in the development of unacceptable levels of hydrogen phosphide. Do not allow reentry into treated areas by any person before this time unless protected by an approved respirator.

5 HANDLING UNAERATED COMMODITIES
Transfer and processing of a treated commodity prior to complete aeration is permissible however, workers must not be exposed to hydrogen phosphide in excess of the permitted exposure limits.

6 INDUSTRIAL HYGIENE MONITORING
It is recommended that hydrogen phosphide exposure be documented in an operation log or manual for each site and operation where exposure may occur. The purpose of this monitoring is to prevent excessive exposure and to determine when and where respiratory protection is required. This monitoring is mandatory although once exposures have been adequately characterized, subsequent monitoring is not routinely required. However, spot checks should be made occasionally, especially if conditions significantly change or an unexpected garlic odor is detected. Gas concentration measurements should be taken in the worker's breathing zone. Monitoring is not required outdoors.

7 ENGINEERING CONTROLS AND WORK PRACTICES
If initial monitoring shows that workers are exposed to concentrations in excess of the permitted exposure limits then engineering controls (such as forced air ventilation) and/or appropriate work practices should be used where possible in an attempt to reduce exposure to below permitted limits.

N. STORAGE AND DISPOSAL

1 STORAGE
Flasks should be stored in a dry, well ventilated area away from heat and under lock and key. Post as a pesticide storage area. Do not contaminate water, food or feed by storing pesticides in the same areas used to store these commodities. Do not store in buildings where humans or domestic animals reside. Keep out of reach of children.

Delta® Tablets and Pellets are supplied in gas tight resealable aluminum flasks. Do not expose the product inside flasks to atmospheric moisture any longer than is necessary. Seal tightly before returning opened flasks to storage. The shelf life of Delta® is virtually unlimited if the containers are tightly sealed.

Flasks should not be stored at sub-zero temperatures because this will increase the possibility of an ignition (flash) when opened.

2 DISPOSAL OF <u>UNREACTED</u> OR <u>PARTIALLY REACTED</u> TABLETS OR PELLETS
(From spills, leaking flasks or other sources) Unreacted or partially reacted Delta® Pellets or Delta® Tablets are acutely hazardous. Improper disposal of these products is a violation of federal law. If these products cannot be disposed of by ordinary use or according to the instructions that follow, contact your state pesticide or environmental control agency or the hazardous waste representative at the nearest EPA regional office for guidance. Do not contaminate water by disposal.

Some local and state waste disposal regulations may vary from the following recommendations. Disposal procedures should be reviewed with appropriate authorities to ensure compliance with local regulations.

FOR SPECIFIC INSTRUCTIONS SEE SPILL AND LEAK PROCEDURES ON PAGE 20 OF THIS MANUAL

3 DISPOSAL OF PELLET OR TABLET DUST FOLLOWING A SPACE FUMIGATION

a <u>General</u>
If properly exposed, the residual dust remaining after a fumigation with Delta® will be a grayish white spent nonhazardous waste and will contain only a small amount of unreacted aluminum phosphide. However, residual dust from incompletely exposed pellets or tablets (See "EXPOSURE GUIDE" on page 8 of this manual.) will require special care. Confinement of <u>partially</u> spent residual dust, as in a closed container or collection and storage of large quantities of this

dust may result in a fire hazard. Small amounts of hydrogen phosphide may be given off from the unreacted aluminum phosphide, and confinement of the gas may result in a flash. UNLESS IT CAN BE DETERMINED WITH CERTAINTY THAT THIS DUST IS SPENT IT MUST BE HELD FOR SEVERAL DAYS BEYOND THE REQUIRED EXPOSURE TIME PRIOR TO DISPOSAL OR THE WET METHOD (SEE BELOW) OF DEACTIVATION MUST BE USED. IF THE DUST RETAINS ANY OF ITS GREENISH COLOR THE WET METHOD IS RECOMMENDED.

b <u>Dry Method</u>
In open areas, small amounts (up to 5 flasks) of residual dust may be disposed of on site by burial or by spreading over the land surface away from inhabited buildings. Up to 3 flasks of this residual dust (4 to 7 lbs.) may be collected in a one gallon bucket for holding or disposal. Larger amounts of residual dust may be collected in a porous cloth bag (burlap, cotton, etc.) for holding and/or transportation to a suitable disposal site. Do not put more than one half case (8 flasks of tablets or 10 flasks of pellets) of residual dust in each bag. Always transport these bags in an open vehicle. Do not pile bags. **CAUTION: Do not use this method for dust that still retains some of its original greenish color. Never confine, dispose of or store residual dust in closed containers such as dumpsters, drums or plastic bags.**

Spent residual dust from Delta® may be collected and disposed of at a sanitary landfill, approved pesticide incinerator or other approved sites or by other procedures approved by federal, state and local authorities.

Do not dispose of dust in a toilet.

c <u>Wet Method</u>
Fill an appropriate sized metal container 2/3 full with water. For each gallon of water add 1/4 cup of low sudsing detergent or surfactant. Use no less than 10 gallons of water/detergent solution for each case of spent material. Slowly pour the dust into the container as the water is stirred. Wear appropriate respiratory protection. DO NOT COVER THE CONTAINER AT ANY TIME. This must be done outdoors or in front of an adequate fan that exhausts immediately outside.

Dispose of the water/dust mixture (slurry) (with or without preliminary pouring out of excess water) in a sanitary landfill or other suitable burial site approved by local authorities. Where permissible the slurry may be poured out on the ground. If it is held 36 hours it may be poured into a storm sewer.

4 DISPOSAL OF EMPTY FLASKS

a <u>Method One</u>: Triple rinse flasks and stoppers with water. Then offer for recycling or reconditioning or puncture and dispose of them in a sanitary landfill or other approved site or by other procedures approved by state and local authorities. Dispose of rinsate in a sanitary landfill or by other approved procedures. Small quantities can be poured out on the ground.

b <u>Method Two</u>: Remove lids and place empty flasks outdoors or in structure being fumigated until residue in flasks is reacted. Puncture and dispose of them in a sanitary landfill or other approved site or by other procedures approved by state and local authorities.

O. SPILL AND LEAK PROCEDURES

1 GENERAL
A spill, other than incidental to application or normal handling, or punctured flasks can produce high levels of gas, and therefore, attending personnel must wear a SCBA or its equivalent when the concentration of hydrogen phosphide gas is unknown. If the concentration is known, other NIOSH/MSHA approved respiratory protection can be worn. Wear dry cotton or other gloves when handling spilled material.

2 DAMAGE TO FIBERBOARD CASE
Check aluminum flasks. If they are damaged handle as described on page 21. If they are undamaged return them to cardboard cartons or other suitable packaging which complies with DOT regulations.

3 LEAKING FLASK PROCEDURES

If aluminum flasks have been punctured or damaged causing a leak, the product may be immediately used, the container may be temporarily repaired with aluminum tape or the Detia® may be transferred from the damaged flask to a sound metal container which should be sealed and properly labeled as aluminum phosphide. Transport the damaged containers to an area suitable for pesticide storage for inspection. Further instructions and recommendations may be obtained, if required, from Research Products Company.

Handle empty damaged containers as described under "DISPOSAL OF EMPTY FLASKS" above.

4 SPILL PROCEDURES

Do not flush spillage down drain with water. DO NOT use water at anytime to clean up a spill. Water in contact with unreacted tablets or pellets will rapidly accelerate the production of hydrogen phosphide gas and could cause spontaneous ignition of the gas. If the spill is only a few minutes old and is not contaminated by other materials, collect the spillage and place it back into the original flask or other sound metal container and tighten the cap. If possible, use immediately. CAUTION: AN IGNITION MAY OCCUR WHEN THESE CONTAINERS ARE REOPENED.

If the spilled material is contaminated or has begun to visibly decompose, gather it up and place it into open top, perforated gallon cans and process it immediately.

Do not add more than about one flask (2 to 3 lbs.) of spilled material to the bucket. If on-site deactivation is not feasible, these open containers should be transported in open vehicles to a suitable area away from occupied buildings. Wet or dry deactivation may then be carried out as described in the section immediately below.

5. DEACTIVATION AND DISPOSAL OF <u>UNREACTED OR PARTIALLY REACTED TABLETS</u> OR PELLETS

a <u>Wet Method</u>

Transport material by hand or in open vehicles to open air away from occupied structures. Fill a drum 2/3 full with water.

Add 1/4 cup of low sudsing detergent or surfactant in each gallon of water. Each flask of tablets or pellets should be mixed with no less than 1 gallon of water/detergent solution. Slowly pour the material into the water as it is stirred. Stir occasionally thereafter for at least 36 hours. Wear appropriate respiratory protection. DO NOT COVER THE CONTAINER. IF THE CONTAINER IS COVERED THE HYDROGEN PHOSPHIDE BEING GENERATED WILL BE CONFINED AND WILL DECOMPOSE EXPLOSIVELY. The wet method of deactivation is the method of choice for quantities in excess of 5 flasks (10 to 15 pounds). It is safe to dispose of this slurry.

Dispose of the resulting deactivated slurry, with or without preliminary pouring out of excess water, at a landfill or other suitable burial site approved by local authorities. Where permissible this slurry may be poured into a storm sewer or out onto the ground.

b. <u>Dry Method</u>

As an alternative to the wet method, when permissible small amounts (up to 5 flasks) of partially reacted or unreacted material may be spread out in an open, secure area away from occupied buildings to be deactivated by atmospheric moisture.

NOTE: Never place pellets, tablets, their dust or the dust/water slurry in a confined container such as a closed drum or plastic bags. Any hydrogen phosphide generated will be confined and may decompose explosively.